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## THE EFFECT OF A PAINFUL STIMULUS AND ITS RECALL UPON RESPIRATION IN PSYCHONEUROTIC PATIENTS\*

JACOB E. FINESINGER, M.D., AND SARAH G. MAZICK, M.D.\*\*

IN A PREVIOUS study (2) it was shown that the respiratory responses of psychoneurotic patients to ideational stimuli varied in intensity over a distinctly wider range than did the responses of a group of normal control subjects. The greatest reactivity, considerably exceeding the range for the normals, was shown by patients with diagnoses of hysteria, anxiety neurosis and phobia (Group 1). The responses of patients with diagnoses of hypochondriasis, compulsion neurosis and reactive depression (Group 2) was less intense than that shown by a group of normal control subjects. The ideas used as stimuli were in part fantasies, and more especially memories, selected by the subjects themselves when prompted by the investigator to think of pleasant or of unpleasant ideas. The purpose of the present study was first of all to test the reactions of a similar group of patients and control subjects to an immediate sensory stimulus. In the second place we were interested in testing the reactivity of these groups of individuals to the recall of a current experience. Both purposes were attained by studying respiration during an experimental situation which consisted in administering a pain stimulus and after a short interval of time asking the subjects to recall their feelings during the period when the pain stimulus was adminis-

tered. The respiration was also studied during a preliminary control period. The reactions of 39 psychoneurotic patients of various diagnoses and of 14 control subjects are presented in this report.

The experiments to which the present paper refers have been briefly described in a previous paper (3), where the data on minute respiratory volume were summarized and compared with the results of the study on ideational stimuli referred to above. In the present paper the data on minute respiratory volume as well as on rate and depth of respiration, metabolic rate and E-I angle are presented in detail.

### TECHNIC

Three types of painful stimuli were used in these experiments, and the experiments are accordingly designated as Experiments A, B and C.

Experiment A: Saline, from 0.25 cc. to 2 cc., was injected intracutaneously in the region of the arm over the insertion of the deltoid.<sup>1</sup>

Experiment B: The skin was repeatedly pricked with a no. 20 gauge hypodermic needle over a definite area lateral to the antecubital fossa.

Experiment C: An electric shock was administered to the right middle finger

\* This is the third in a series of studies on respiration in psychoneurotic patients.

\*\* From the Department of Diseases of the Nervous System, Harvard Medical School and the Psychiatric Department, Massachusetts General Hospital.

<sup>1</sup> For patients no. 30, 31, 32 and 33 the amount of saline injected was  $\frac{1}{4}$  cc.,  $\frac{1}{2}$  cc.,  $\frac{3}{4}$  cc., and  $1\frac{1}{2}$  cc. respectively. In patients 1, 3, 4, 5, 6, 7, 9, 29 and 30 the amount injected was 1 cc. In patient no. 2 the amount was 2 cc. For the control subjects 1 cc. of saline was injected in subjects 1, 3 and 4, and 2 cc. was injected in subject 2.

from the secondary circuit of a Harvard inductorium, connected to a ring electrode fastened to the finger tip. The secondary coil was set at position 8 and a 2-volt dry cell battery was used.

Some of the subjects (patients and controls) were given several tests with the same or different stimuli. When more than one experiment with the same stimulus was carried out on a single subject, only the first experiment was included in this series. When two different pain stimuli were used, the first experiment with each stimulus was included.

The respiratory functions studied included rate of respiration, depth of respiration, minute respiratory volume, metabolic rate and expiratory-inspiratory angle (E-I angle) (2, 9). Values for these functions were derived from an analysis of records obtained by means of a Benedict-Roth metabolism apparatus. The patient and control subjects in this series had already had previous experience with this apparatus, having had basal metabolic determinations prior to the present test. The patients were mostly ward patients who walked down to the metabolism laboratory on the morning of the test and were instructed to lie down for a period of at least one half hour before the test began. The few ambulatory out patients and the control subjects were instructed to take no food after the evening meal of the previous day and to take no fluids after midnight. They came directly to the laboratory from the outside the morning of the test and similarly lay down for at least one half hour before a routine metabolism test was done. After the routine metabolism test they remained lying for at least another half hour and then the experimental procedure, which lasted from fifteen to twenty minutes, was started. Hence at the start of the test basal conditions obtained, in that the subjects, both pa-

tients and controls, had not eaten since midnight of the preceding day, and had been lying in bed for at least one half hour.

During the tests the subjects were attached to the metabolism apparatus as in the routine basal metabolism tests. They breathed oxygen, the nose clip and mouthpiece were used, and the usual precautions were taken to ascertain that the apparatus was functioning properly. The record was started with a preliminary period which lasted for 3 to 6 minutes. For Experiments A and B, but not for Experiment C, this period was followed by a period of one minute during which time the arm was rubbed with an alcohol sponge (alcohol period). The period during which the pain stimulus was administered (pain period) followed within 1 or 2 minutes after the alcohol period for Experiments A and B; and directly after the preliminary period for Experiment C. The pain period lasted from 2 to 3 minutes. The record was then continued in all experiments for an interval of from 3 to 6 minutes (interval period). This period was followed by the "recall period" which lasted from 3 to 6 minutes. During this period the investigator made repeated suggestions at intervals of 15 to 30 seconds. These suggestions were for Experiments A and B, "Think of the way you felt when I was putting the needle into your arm," and for Experiment C, "Think of the way you felt when your finger was being hurt." After the recall period the subject was disconnected from the apparatus and was asked to report on the ideas in his mind during the recall period.

The respiratory records were analyzed in the following manner. The rate of respiration was counted directly. The depth of inspiration, which throughout the present paper is used synonymously with depth of respiration, was obtained by measuring in millimeters the vertical

distance between each trough and the successive peak in the record, and converting the values into volumes of gas expressed in cubic centimeters. The product of the respiratory rate and depth of inspiration (expressed in liters) gives the value for the minute respiratory volume expressed in liters. The rate of oxygen consumption was calculated in the usual routine way and is presented as the metabolic rate in percentages. Because of the pain and the ideational stimulation it cannot be referred to as basal metabolic rate. The respiratory curves were also classified in terms of E-I angle. This angle refers to the abruptness of transition occurring between an expiration and the subsequent inspiration. It is a measure of the angle between the downstroke and the upstroke of the pen. The procedure in measuring and classifying the E-I angle has been previously described in detail (2).

#### DATA

The subjects for these experiments included 39 psychoneurotic patients and 14 normal controls. The patients had been under observation and treatment in the psychiatric ward or the out-patient department of the Massachusetts General Hospital. The patients were classified into two groups according to the hospital diagnoses. Group 1 consisted of patients whose hospital diagnoses were anxiety neurosis, hysteria and phobia. It included 27 patients, 9 males and 18 females, whose ages ranged from 15 to 47 years. Group 2 consisted of patients whose diagnoses were hypochondriasis, reactive depression, compulsion neurosis and questionable schizophrenia. In this group were 12 patients, 2 males and 10 females, whose ages ranged from 22 to 49 years. The fourteen control subjects (6 males, 8 females) whose ages ranged from 18 to 33 years were doctors, social workers,

medical and college students. They were not subjected to a medical examination. The term "control" subjects thus refers to ambulatory, non-psychotic, healthy persons who in contrast to the patients had no outstanding psychoneurotic symptoms as far as could be determined in one interview.

The data are presented in Tables 1 to 10. The complete data for the respiratory rate, depth of respiration, minute respiratory volume and expiratory-inspiratory angle are presented in Tables 1, 3, 5, and 8. Mean values for the group and for the various types of experiments are presented in Tables 2, 4, 6, 7, and 9. The summaries of the case histories and the diagnoses are presented at the end of the paper.

#### ILLUSTRATIVE CASES

Experiments in 3 illustrative cases, a patient in Group 1, a patient in Group 2 and a control subject are presented below.

Patient No. 11, M.M. A 39-year-old, white, married, native born, female was admitted complaining of pain in the right side of the back of 7 years' duration. Since the age of 16 the patient had complained of poor health and had 10 operations, including hysterectomy. She was also nervous, "jittery," and had attacks of palpitation. Since her last operation 5 years ago she has complained of a continuous pain in her right flank and bladder region. Physical examination showed tremor of the tongue and out-stretched fingers. Hands and feet were cold and sweating, and there was moderate sinus arrhythmia. At times she showed typical "glove" hypesthesia to pin prick in both hands. Laboratory examination, including blood non-protein nitrogen, calcium and phosphorus, x-ray of chest, and intravenous pyelogram were within normal limits.

Diagnosis: Hysteria.

The respiratory record of this patient is shown in Fig. 1 and the record is charted in Fig. 2.

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Diagnosis: Hysteria.

The respiratory record of this patient is shown in Fig. 1 and the record is charted in Fig. 2.

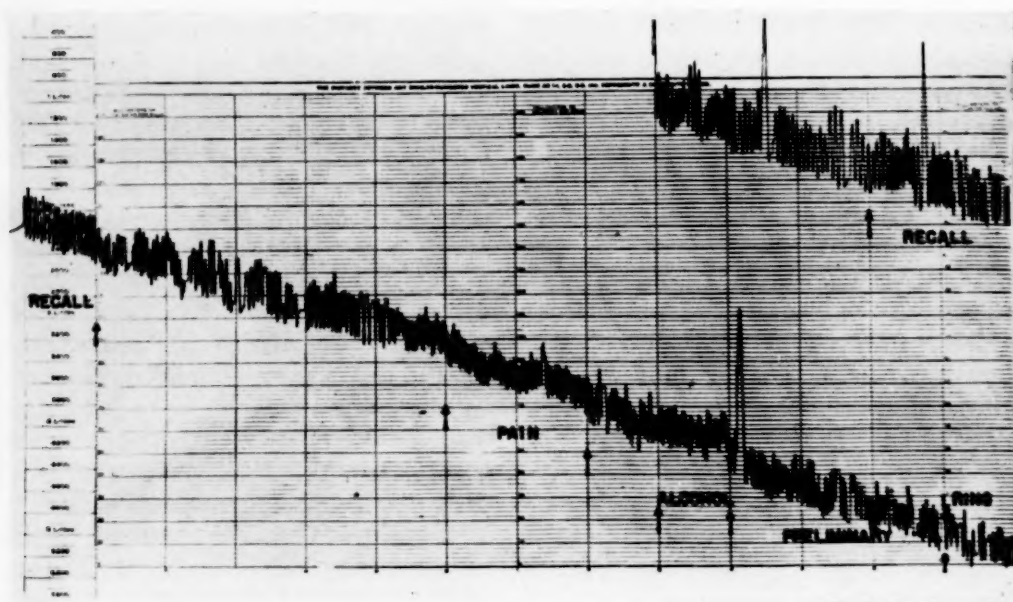


FIG. 1. Continuous record of a complete experiment (Type B) on patient 11, showing preliminary, alcohol, pain, interval and recall periods.

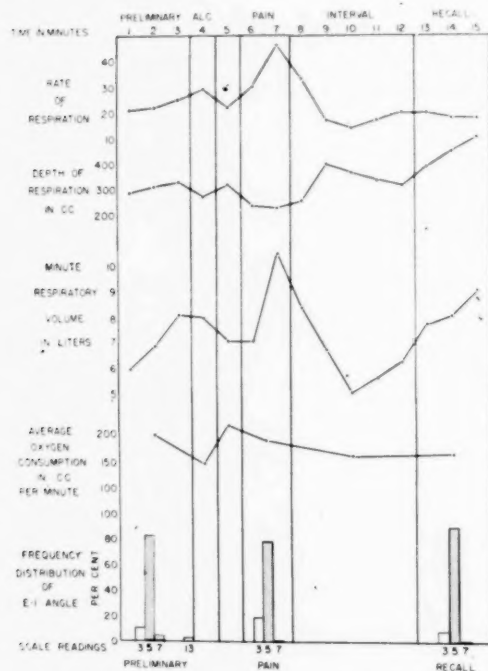


FIG. 2. Chart showing analysis of figure 1 for rate, mean depth of respiration, minute respiratory volume, mean oxygen consumption, and frequency distribution of the expiratory-inspiratory angles.

After the test the patient answered that she had felt the pain (Experiment B) on having her skin punctured repeatedly by the needle, and that she had vividly recollected the feeling of pain. "I thought of pain and it hurt. Every time you stuck it in it burned and smarted. I thought of it all the time you told me to."

The chart (Fig. 2) represents a case in which there is a great increase in rate of respiration during the pain period with a slight decrease during the recall period. During the pain period the depth decreased below the preliminary value and during the recall period it was greater than during the preliminary and interval periods. The minute respiratory volume rose during the pain period, reached a minimum for the interval period and rose again during the recall period. This chart illustrates two of the ways in which an increase in minute respiratory volume can be brought about, namely by an increase in rate even though associated with a

decrease in depth as during the pain period, and by an increase in depth in spite of a decrease in rate as during the recall period. The oxygen consumption showed little change during the pain period and dropped slightly during the interval and recall periods. The E-I angle showed a shift toward the lower values (more acute angles) during the pain and recall periods.

Patient No. 31, H.O. A 28-year-old, white, native born, single female complained of vomiting, pressure in her head, feelings of numbness in arms and legs for a period of 6 years. During the last four months these symptoms have been coming on with greater persistency and in addition the patient has noticed vague abdominal pressure sensations. She has been feeling depressed for the last four months and states that she weeps easily when certain topics are brought up. Appetite and sleep are normal and there is only a slight loss of weight. Physical and neurological examinations were negative. Mental status shows a person who cries readily, complains in a vague way about head, arms and legs, and abdomen.

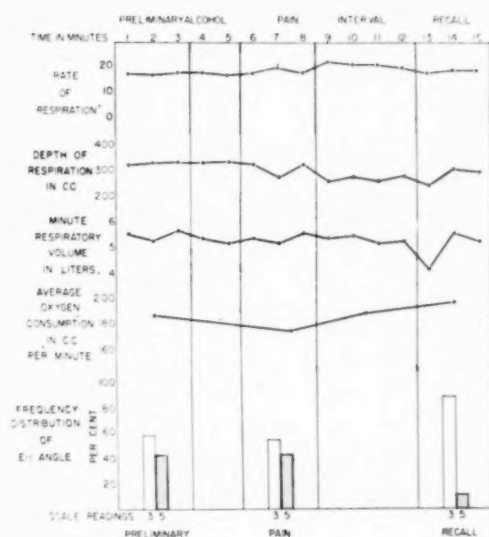


FIG. 4. Chart showing analysis of figure 3 for rate, mean depth of respiration, minute respiratory volume, mean oxygen consumption and frequency distribution of the expiratory-inspiratory angles.

Diagnosis: Hypochondriasis; Reactive Depression.

The respiratory record of this experiment is shown in Fig. 3, and the data

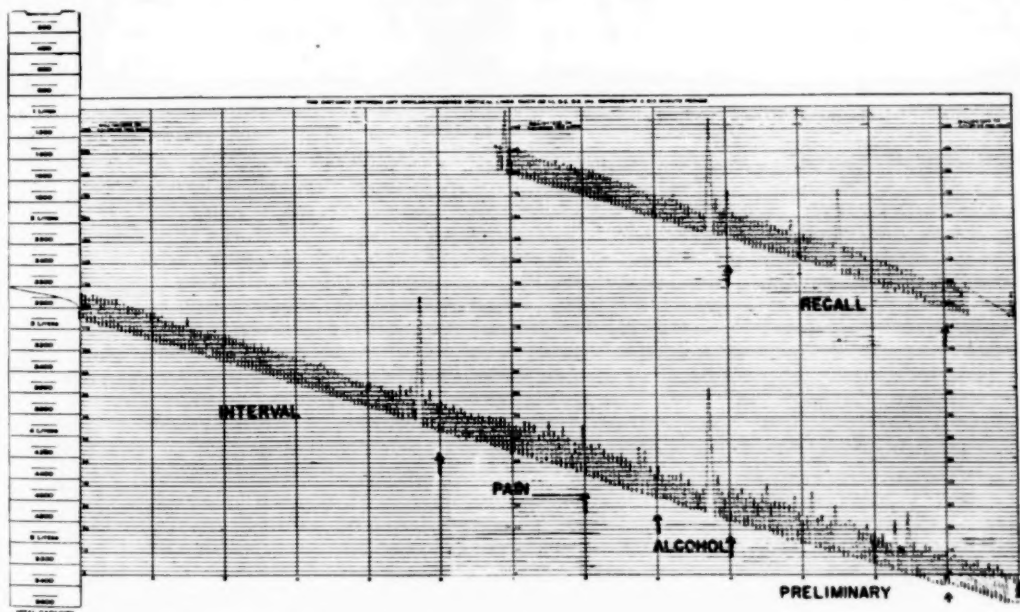


FIG. 3. Continuous record of a complete experiment (Type A) on patient 31. The duration of the various periods was preliminary 3 minutes, alcohol 1 minute, pain 2 minutes, interval 5 minutes, and recall 5 minutes.

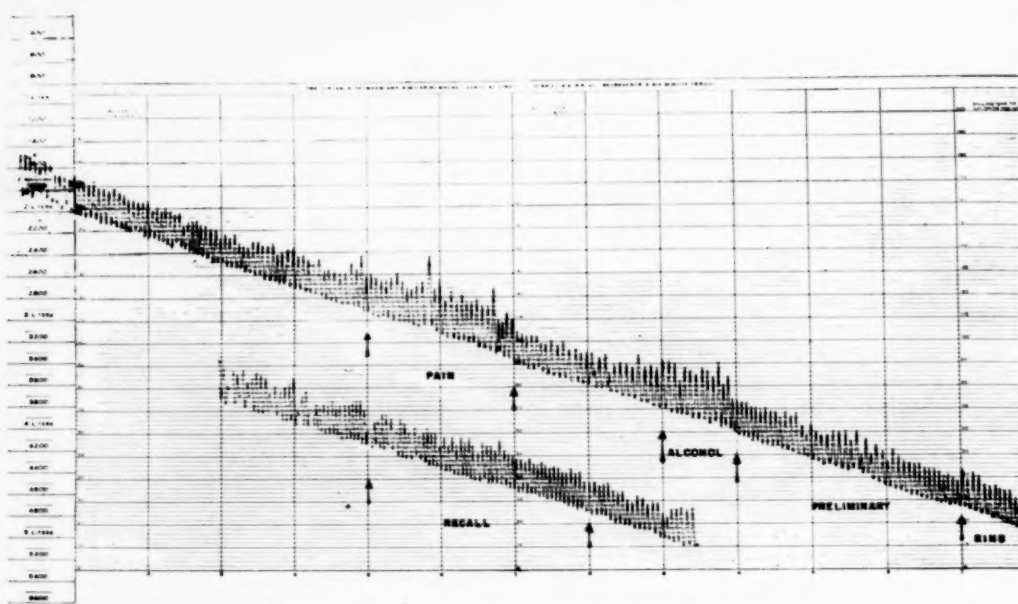


FIG. 5. Continuous record of an experiment (Type A) on control subject 2. The duration of the various periods was preliminary 3 minutes, alcohol 1 minute, pain 2 minutes, interval 3 minutes and recall 3 minutes.

derived from the record are charted in Fig. 4.

The patient stated that she had felt the pain (Experiment A) during the injection. During the recall period she stated that she had thought of the way she felt during the injection. "I thought again and again of your putting the needle in my skin. I thought of the way it stung and smarted and kept getting worse and worse until I felt the skin would break."

In this patient (Fig. 4) the rate increased slightly during the pain period. It rose again to a maximum during the interval period, but the actual changes involved were slight. The mean value for the interval period exceeded that for the preliminary period by only 2 respirations per minute. The depth of respiration remained relatively unchanged during the test. There was a slight drop during the pain period which was sustained during the interval and recall periods. The minute respiratory volume also showed little change during the test with the exception of a drop of 1

liter in the first minute of the recall period. The oxygen consumption was minimum during pain and maximum during recall, but the changes involved were small. The E-I angle values were essentially the same for the preliminary and pain periods. There was a shift toward the direction of Group 3 (acute angles) during the recall period.

The respiratory record of control subject No. 2, a 32-year-old, unmarried, native born, white female is presented in Fig. 5. The analysis of this record is charted in Fig. 6.

The subject stated that she had felt the pain (Experiment A) and that during the recall period thought of "the pain and the burning sensation."

In an analysis of Fig. 6 the rate showed little change except for an increase of 2 respirations per minute during the recall period. The depth increased during alcohol and again during pain. The changes in minute respiratory volume were parallel to those of the depth. The oxygen consumption dropped during the alcohol period, rose

during the pain and interval periods and fell again during the recall period. Again the E-I angle showed more broad angles during the preliminary period than during the pain and recall periods. The greatest number of acute angles (Group 3) were seen during the recall period.

#### IDEAS REPORTED

All of the patients stated that they had felt pain during the period of stimulation. The descriptions showed little variation from individual to individual. Two patients (nos. 18 and 24) stated that the pain was not severe. For Experiment A the descriptions included feelings of localized hurt, smart, burning sensations, sensations of local pressure, and feelings that the skin would break. For Experiment B the descriptions included piercing pain, burning sensations, feelings of hurt on being stuck, and pressure sensations. In Experiment C there were descriptions of pain, numbness, vibrating pain, feeling

of electrical pain, feelings like getting an electric shock. With the exception of 2 patients (nos. 17 and 38) all of the patients and control subjects answered that they had been able to think of the pain feelings during the recall period. Their descriptions for this period agreed with the descriptions of the actual sensations during the pain period. Four patients (nos. 3, 12, 13 and 23) described feelings of unpleasantness in addition to the feelings associated with pain during the recall period. Since the answers were so characteristic and stereotyped the complete data on the ideas reported is not presented in detail.

#### RATE OF RESPIRATION

The average rates of respiration during each test, calculated separately for each period, are given in Table 1. The mean values for each group of subjects, derived from these individual values, are summarized by period in Table 2. This summary table for rate and similarly summary Tables 4, 6, 7 and 9 for the other respiratory functions, are arranged in four sections. The first section gives the complete summary of all the experiments given in Table 1. The second, third and fourth sections are summaries of Experiments A, B and C respectively. A selected summary is also given (section at the bottom of Table 2) in which only the first experiment on a given subject is included, irrespective of the type of stimulus used. In the columns to the right of the mean rates for the five periods are tabulated separately for each group of subjects the increase in rate for the pain period and for the recall period with respect to the preliminary period, in respirations per minute. Negative values refer to a decrease in rate. The difference between the value for the recall period and the preceding interval is given in parentheses after the value for the recall period. This difference is

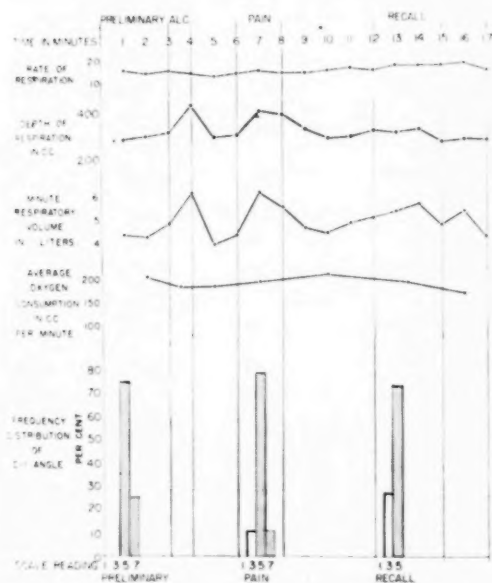


FIG. 6. Chart showing analysis of figure 5 for rate, mean depth of respiration, minute respiratory volume, mean oxygen consumption and frequency distribution of the expiratory-inspiratory angles.

TABLE I  
MEAN RATE OF RESPIRATION PER MINUTE FOR EACH PERIOD

No.	Preliminary		Alcohol		Pain		Interval		Recall	
	Duration of Period in Minutes	Average Rate per Minute	Duration of Period in Minutes	Average Rate per Minute	Duration of Period in Minutes	Average Rate per Minute	Duration of Period in Minutes	Average Rate per Minute	Duration of Period in Minutes	Average Rate per Minute
Group I										
1	3	11	1	11	1	11	5	9	1	11
2	3	10	1	11	2	11	4	11	3	11
3	3	9	1	9	2	11	4	12	3	18
4	3	17	1	19	2	20	9	16	2	21
5	3	14	1	17	2	18	7	15	3	15
6	3	13	1	12	1	10	8	12		
7	3	15	1	16	1	17	9	17		
8	3	10	1	8	2	13	4	9	3	12
9	3	28	1	34	2	36	5	26	3	27
10	3	18	1	18	2	19	3	21	3	17
11#	3	23	1	29	2	38	5	20	3	19
12#	3	10	1	21	3	21	3	22	3	22
13#	0	14	1	17	3	15	4	14	3	14
14#	3	12	1	14	2	35	5	17	3	23
15#	3	15	1	15	3	16	5	15	3	14
16#	3	15	1	18	2	25	0	20	3	16
17#	3	14	1	18	3	19	5	15	3	16
18#	3	10	1	8	3	9	5	10	3	12
19#	3	23	1	28	2	32	4	27	3	25
19##	3	25			3	27	5	28	3	17
20#	3	17	1	19	3	17	5	28	3	29
21#	3	23	1	19	2	21	5	21	3	30
21##	3	20			3	43	5	24	3	37
22#	3	15	1	16	2	16	5	15	3	14
22##	3	16			3	18	5	16	3	15
23#	3	13	1	15	2	14	5	17	3	13
23##	3	16			3	19	5	15	3	14
24#	3	18	1	17	3	17	5	18	3	18
25#	3	14	1	16	3	27	5	12	3	23
25##	3	14			3	18	5	23	3	21
26##	3	11			3	12	5	11	3	12
27##	3	7			3	15	3	11	3	12
Group II										
28	3	15	1	16	2	16	11	15	3	18
29	3	17	1	16	2	14	5	15	3	17
30	3	14	1	14	1	10	3	14	2	17
31	3	17	1	17	2	18	5	19	3	18
32	3	11	1	13	1	10	4	10	3	11
33	3	23	1	23	2	22	6	23	3	28
34#	3	15	1	16	2	17	4	15	3	17
35#	3	20	1	22	3	19	4	19	4	22
36#	3	12	1	12	3	12	5	12	3	12
36##	3	11			3	10	5	12	3	13
37#	3	19	1	19	3	18	4	20	3	20
38#	3	18	1	16	3	15	5	17	3	16
38##	3	16			3	17	5	17	3	15
39#	3	12	1	10	2	11	5	11	3	14
Controls										
1	3	14	1	15	2	16	6	14	3	15
2	3	15	1	14	2	15	4	15	3	17
3	3	10	1	15	2	16	3	15	3	15
4	3	13	1	17	2	21	6	15	3	16
5#	3	17	1	17	3	19	5	14	3	17
5##	3	18			3	19	4	18	3	23
6#	3	11	1	10	3	9	5	10	3	10
6##	3	10			3	9	5	10	3	10
7#	3	10	1	13	3	11	5	11	3	12
8#	3	14	1	14	3	13	4	13	3	14
8##	3	16			3	17	4	15	3	17
9#	3	8	1	8	3	8	4	9	3	12
9##	3	8			3	8	5	9	3	12
10#	3	13	1	13	3	13	4	14	3	15
10##	3	14			3	13	5	22	3	16
11#	3	15	1	18	3	19	4	16	3	16
11##	3	18			3	18	5	15	3	18
12#	3	18	1	20	3	17	5	20	3	21
12##	3	20			3	21	5	19	3	24
13#	3	15	1	16	3	16	5	15	3	15
13##	3	14			3	16	5	15	3	16
14#	3	15	1	12	3	11	4	12	3	15
14##	3	13			3	14	5	12	3	17

Numbers marked # refer to Experiment B.  
Numbers marked ## refer to Experiment C.  
All other numbers refer to Experiment A.

TABLE 2  
RATE OF RESPIRATION  
Mean Rate During Each Period in Respirations Per Minute

	Number of Experi- ments	Prelimi- nary Period	Alcohol Period	Pain Period	Interval Period	Recall Period	Increase with Respect to Preliminary Period	
							Pain	Recall
<i>General Summary Experiments A, B &amp; C (from Table 1)</i>								
All patients. . . . .	46	15.8	16.7	18.6	16.7	18.0	2.8	2.2(1.3)
Group 1. . . . .	32	15.8	17.0	20.0	17.1	18.5	4.2	2.7(1.4)
Group 2. . . . .	14	15.7	16.2	15.6	15.5	17.0	-0.1	1.3(1.5)
Controls. . . . .	23	13.9	14.4	14.7	14.3	15.8	0.8	1.9(1.5)
<i>Experiment A</i>								
Group 1. . . . .	10	14.5	15.5	16.6	14.8	16.5	2.1	2.0(1.7)
Group 2. . . . .	6	16.2	16.5	16.5	15.7	18.2	0.3	2.0(2.5)
Controls. . . . .	4	13.0	15.3	17.0	14.8	15.8	4.0	2.8(1.0)
<i>Experiment B</i>								
Group 1. . . . .	15	16.3	18.0	21.4	18.1	19.6	5.1	3.3(1.5)
Group 2. . . . .	6	16.0	15.8	15.3	15.7	16.8	-0.7	0.8(1.1)
Controls. . . . .	10	13.6	14.1	13.6	13.4	14.7	0	1.1(1.3)
<i>Experiment C</i>								
Group 1. . . . .	7	16.4		21.7	18.3	18.3	5.3	1.9(0)
Group 2. . . . .	2	13.5		13.5	14.5	14.0	0	0.5(-0.5)
Controls. . . . .	9	14.6		15.0	15.0	17.0	0.4	2.4(2.0)
<i>Selected Summary First Experiment Only</i>								
Group 1. . . . .	27	15.1	17.0	19.0	16.3	18.0	3.9	2.9(1.7)
Group 2. . . . .	12	16.1	16.2	15.9	15.7	17.5	-0.2	1.4(1.8)
Controls. . . . .	14	13.4	14.4	14.6	13.8	15.0	1.2	1.6(1.8)

Values in parentheses indicate the difference between the recall period and its preceding interval period.

shown as positive (+) when it represents an increase for the recall period. This is included as a check on the preceding figure, in so far as the rate might not have fallen appreciably in the interval after the pain.

*Patients of Group 1. (a) Range and Summaries.* For the 32 experiments on 27 patients of Group 1 the rate of respiration ranged from 7 to 28 respirations per minute for the preliminary period (mean 15.8, see Complete Summary section, Table 2); from 8 to 34 for the alcohol period (mean 17.0); from 9 to 43 for the pain period (mean 20.0); from 9 to 28 for the interval period (mean 17.1) and from 11 to 37 (mean 18.5), for the recall period. From these individual values and group averages from the complete summary (see also

Fig. 7) it appears that there was some acceleration in respiration during the process of rubbing the arm with alcohol, a pronounced further acceleration during the administration of the pain

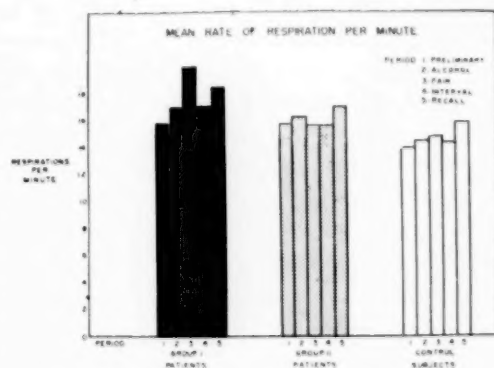


FIG. 7. Chart showing mean rate of respiration during each period for all experiments on patients and control subjects.

stimulus, a return to about the alcohol level during the interval after the pain, and again acceleration during the period of recall of the pain.

The increase in rate of respiration for Group 1 patients during the pain period appears also very consistently in the summaries of Experiment A, B and C, as well as in the selected summary of first experiments, and amounts to between 2 and 5 respirations per minute. The increase during the recall period for this same group of patients is also quite marked (between 2 and 3 respirations per minute) for Experiments A and B, where it is confirmed as a real acceleration since the figure in parentheses shows that the rate was also at least  $1\frac{1}{2}$  respirations more rapid than the mean for the interval period. For Experiment C there also appears an increase of about 2 respirations during the period of recall, but the significance is questionable since in these experiments the mean rate for this period is the same as during the interval.

(b) *Consistency.* The consistency of these trends can be examined briefly. For this purpose an increase by only 1 respiration per minute with respect to the preliminary period will be arbitrarily classed as no change in rate wherever it occurs in an individual experiment;<sup>2</sup> an increase of from 2 to 4 respirations per minute will be referred to as a slight acceleration, and increases exceeding 8 respirations per minute will be referred to as marked or pronounced acceleration.

In 19 of the 32 tests on patients of Group 1 (60 per cent), the respiration was accelerated for the pain period. This acceleration was pronounced in 8 tests, in one case amounting to 23 respirations per minute. It should be noted that in 2 of these tests the rate had accelerated to about the same value

during the preceding alcohol period. In 11 of these 19 tests the recall period also showed a higher rate than that of the preliminary period, the maximum increase being 11 respirations per minute. The significance of this acceleration for the process of recall of pain is lessened in that in 5 of these 11 cases the rate for the recall period, although somewhat greater than that for the preliminary period, is roughly equal to or is even less than the rate for the preceding interval that followed the pain. Of the 13 tests on these patients in which no acceleration in respiration appears for pain, 9 also showed no acceleration for the recall period. Hence in a total of 14 of 21 tests for which data for recall are available (67 per cent), the rate for the recall period exceeded that for the preliminary period.

*Patients of Group 2. (a) Range and Summaries.* For the 14 experiments on 12 patients of Group 2, the rate of respiration ranged from 11 to 23 respirations per minute during the preliminary period (mean 15.7); from 10 to 23 during the alcohol period (mean 16.2); from 10 to 22 during the pain period (mean 15.6); from 10 to 23 during the interval after the pain (mean 15.5); and from 11 to 28 (mean 17.0) during the period of recall. From these values the rate of respiration appears to have remained relatively unchanged during the first four periods of the test, including the pain period, but to have accelerated somewhat for the period during which the pain was recalled.

For the patients of Group 2 the absence of an acceleration in rate of respiration during the pain period is seen not only in the complete summary but also in the selected summary of first experiments, and in the separate sections for Experiments A, B and C, where the difference between the pain and the preliminary periods are respectively 0.3, -0.7 and 0 respirations per minute.

<sup>2</sup> A change in rate of even 1 respiration in the group average values cannot be disregarded.

The acceleration in rate for the recall period appears in the selected summary, as well as in the summaries for Experiments A and B. This acceleration amounts to 2 respirations per minute in Experiment A (6 experiments) and to 0.8 respirations per minute in Experiment B (6 experiments). In both cases there is a comparable acceleration with respect to the preceding interval period. For the two experiments on Group 2 patients with stimulus C the acceleration for recall is 0.5 respirations per minute, but the rate for this period is actually less than during the preceding interval.

(b) *Consistency.* Acceleration for the pain period as compared with the preliminary period appears in only 2 of the 14 tests (14 per cent) on the patients of Group 2. In both cases the increase is small, and is accompanied by a comparable small increase for the period of recall. There is not one case showing a marked acceleration for either pain or recall periods. In 5 of the remaining 12 tests, in which there appears no appreciable change in rate for the pain period, the recall period showed accelerations of from 2 to 5 respirations. Thus in a total of 7 out of 14 tests (50 per cent), an acceleration of from 2 to 5 respirations per minute occurred during the period of recall. This acceleration was corroborated when the recall period was compared with the preceding interval.

*Control Subjects.* (a) *Range and Summaries.* Rates of respiration for the 23 tests on 14 control subjects show a range of from 8 to 20 respirations per minute for both the preliminary and the alcohol periods (mean values 13.9 and 14.4 respectively); a range of from 8 to 21 for the pain period (mean 14.7); of from 9 to 22 for the interval after pain (mean 14.3); and of from 10 to 24 for the period of recall of the pain (mean 15.8). These values point to

relatively little change in rate of respiration for the controls during the first four periods of the test excepting for a slight increase in the mean for the pain period, with an increase in rate for the period of recall.

The summary for Experiment A, which it should be noted includes only 4 of the 23 tests on the control subjects, shows an acceleration for the pain period of .3 respirations per minute, which greatly exceeds that of the complete summary. Experiment B (10 experiments) gives no acceleration at all for pain, and Experiment C (9 experiments) gives an acceleration of less than one half a respiration per minute. The acceleration for the recall period, on the other hand, which amounts to about 2 respirations in the complete summary, appears definitely in the summaries for Experiments A, B and C (respectively as accelerations of 2.8, 1.1 and 2.4 respirations per minute), and is corroborated by parallel increases in rate for the recall period with respect to the preceding interval. The mean values in the selected summary for first experiments show some acceleration for both pain and recall.

(b) *Consistency.* Acceleration for the pain period as compared with the preliminary period occurred in only 6 of 23 (27 per cent) tests on the 14 control subjects, and amounted to from 2 to 8 respirations per minute. In 3 of these tests the recall period also showed rates that were slightly greater than the rates for the preliminary period, but not appreciably exceeding the corresponding rate for the interval that preceded the recall period. In the 17 remaining tests, in which no acceleration, and indeed an occasional deceleration, appeared for pain, the rate for the recall period exceeded that of the preliminary period by from 2 to 5 respirations per minute in 10 tests; and was approximately equal to that of the preliminary

TABLE 3  
MEAN DEPTH OF RESPIRATION IN CC. FOR EACH PERIOD

No.	Preliminary		Alcohol		Pain		Interval		Recall	
	Duration of Period in Minutes	Average Depth in cc. per Minute	Duration of Period in Minutes	Average Depth in cc. per Minute	Duration of Period in Minutes	Average Depth in cc. per Minute	Duration of Period in Minutes	Average Depth in cc. per Minute	Duration of Period in Minutes	Average Depth in cc. per Minute
Group I										
1	3	1312	1	1130	1	1248	5	1305	1	1472
2	3	408	1	495	2	452	4	470	3	500
3	3	752	1	891	2	698	4	625	3	974
4	3	549	1	589	2	418	9	458	2	251
5	3	308	1	319	2	290	7	344	3	308
6	3	371	1	441	1	580	8	372		
7	3	364	1	300	1	470	0	367		
8	3	592	1	663	2	541	4	770	3	646
9	3	274	1	209	2	201	5	255	3	257
10	3	280	1	325	2	307	3	278	3	290
11#	3	311	1	274	1	228	5	334	3	448
12#	3	435	1	476	3	450	3	397	3	435
13#	6	488	1	420	3	480	4	508	3	400
14#	3	640	1	620	2	480	5	440	3	600
15#	3	397	1	352	3	435	5	373	3	397
16#	3	518	1	518	2	497	6	415	3	580
17#	3	601	1	497	3	518	5	622	3	580
18#	3	704	1	829	3	807	5	704	3	704
19#	3	559	1	373	2	518	4	476	3	373
19##	3	352			3	497	5	311	3	322
20#	3	539	1	539	3	518	5	415	3	397
21#	3	290	1	435	2	470	5	415	3	373
21##	3	269			3	311	5	311	3	397
22#	3	497	1	415	2	602	5	559	3	580
22##	3	518			3	476	5	601	3	580
23#	3	518	1	559	2	642	5	518	3	415
23##	3	559			3	476	5	539	3	559
24#	3	373	1	415	3	450	5	476	3	415
25#	3	601	1	684	3	601	5	559	3	450
25##	3	622			3	663	5	580	3	477
26#	3	497			3	622	5	622	3	559
27##	3	1285			3	1327	5	1430	3	705
Group II										
28	3	460	1	526	2	491	11	516	3	408
29	3	306	1	288	2	352	5	352	3	288
30	3	348	1	340	1	298	3	321	2	280
31	3	325	1	314	2	290	5	276	3	278
32	3	472	1	426	1	532	4	450	3	398
33	3	418	1	366	2	377	6	444	3	414
34#	3	655	1	483	2	582	4	643	3	540
35#	3	440	1	425	3	500	4	471	4	408
36#	3	539	1	559	3	601	5	580	3	622
36##	3	580			3	705	5	601	3	601
37#	3	518	1	476	3	539	4	476	3	518
38#	3	476	1	518	3	622	5	518	3	518
38##	3	559			3	580	5	539	3	580
39#	3	705	1	932	2	829	5	807	3	559
Controls										
1	3	394	1	346	2	348	6	383	3	352
2	3	302	1	435	2	400	4	311	3	305
3	3	367	1	300	2	305	3	358	3	346
4	3	408	1	350	2	398	6	366	3	340
5#	3	539	1	518	3	518	5	497	3	539
5##	3	497			3	518	4	539	3	435
6#	3	704	1	704	3	870	5	870	3	705
6##	3	725			3	1074	5	820	3	787
7#	3	932	1	787	3	829	5	850	3	704
8#	3	476	1	476	3	601	4	642	3	601
8##	3	539			3	580	4	580	3	518
9#	3	807	1	850	3	974	4	995	3	745
9##	3	995			3	974	5	1140	3	643
10#	3	497	1	476	3	476	4	497	3	539
10##	3	539			3	601	5	601	3	539
11#	3	539	1	476	3	539	4	539	3	580
11##	3	497			3	684	5	497	3	642
12#	3	332	1	269	3	373	5	332	3	332
12##	3	311			3	332	5	539	3	332
13#	3	476	1	476	3	518	5	539	3	476
13##	3	497			3	539	5	518	3	497
14#	3	415	1	456	3	559	4	559	3	476
14##	3	415			3	456	5	415	3	373

Numbers marked # refer to Experiment B.  
Numbers marked ## refer to Experiment C.  
All other numbers refer to Experiment A.

TABLE 4  
DEPTH OF RESPIRATION  
Mean Depth During Each Period in cc.

	Number of Experi- ments	Prelimi- nary Period	Alcohol Period	Pain Period	Interval Period	Recall Period	Increase with Respect to Preliminary Period	
							Pain	Recall
<i>General Summary</i> <i>Experiments A, B &amp; C</i> <i>(from Table 1)</i>								
All patients . . . . .	46	515	499	540	524	501	+ 25	-14(-23)
Group 1 . . . . .	32	526	513	546	535	521	+ 20	- 5(-14)
Group 2 . . . . .	14	490	471	526	500	458	+ 36	-32(-42)
Controls . . . . .	23	530	500	588	582	516	+ 58	-14(-66)
<i>Experiment A</i>								
Group 1 . . . . .	10	525	542	533	535	470	+ 8	-55(-65)
Group 2 . . . . .	6	388	377	390	394	344	+ 2	-44(-50)
Controls . . . . .	4	368	377	378	355	336	+ 10	-32(-19)
<i>Experiment B</i>								
Group 1 . . . . .	15	498	494	518	492	485	+ 20	-13(-7)
Group 2 . . . . .	6	566	566	612	583	528	+ 46	-38(-55)
Controls . . . . .	10	572	549	626	632	576	+ 54	+ 4(-56)
<i>Experiment C</i>								
Group 1 . . . . .	7	586		625	628	522	+ 39	-64(-106)
Group 2 . . . . .	2	570		673	570	591	+103	+21(+21)
Controls . . . . .	9	587		640	629	530	+ 83	-27(-99)
<i>Selected Summary</i> <i>First Experiment Only</i>								
Group 1 . . . . .	27	538	513	558	547	532	+ 20	- 6(-15)
Group 2 . . . . .	12	477	471	501	488	436	+ 24	-41(-52)
Controls . . . . .	14	513	499	555	553	507	+ 42	- 6(-46)

Values in parenthesis indicate the difference between the recall period and its preceding interval period.

period in 7 tests. Hence in a total of 13 of the 23 tests (57 per cent) there was some acceleration for the recall period.

*Summary.* Acceleration for the pain period appeared for 60 per cent of Group 1 patients, for only 14 per cent of Group 2 patients and for only 27 per cent of the controls. Acceleration for the recall period occurred for 67 per cent of the Group 1 patients, for 50 per cent of the Group 2 patients and for 57 per cent of the controls.

#### DEPTH OF RESPIRATION

The average depth of respiration during each experiment calculated separately for each period is given in Table 3. The values for the individual subjects differ considerably especially in Group 1 patients, where the range for the preliminary period is from 269

cc. to 1312 cc. The summary of the values in Table 3 averaged separately for each group of subjects, and the additional summaries for each type of experiment appear in Table 4. In considering the consistency of the changes in depth, a change of less than 20 cc. occurring between two periods in an individual test will be considered as no change, and a change of more than 100 cc. as a considerable change.<sup>3</sup>

*Patients of Group 1. (a) Range and Summaries.* The depth of inspiration for the 32 tests on the patients of Group 1 ranged for each of the 5 periods from a low value of between 200 cc. and 300 cc., to a high value of between 1100 and 1500 cc. The mean values for the complete summary were 526 cc. for the

<sup>3</sup> A mean change of 20 cc. derived from summaries of several tests will not be similarly disregarded.

preliminary period, 513 cc. for the alcohol period, 546 cc. for the pain period, 535 cc. for the interval and 521 for the recall period. This gives an increase of only 20 cc. for the pain period, and a decrease of 5 cc. for the recall period. The decrease for recall appears also when the value for this period is compared with that for the preceding inter-

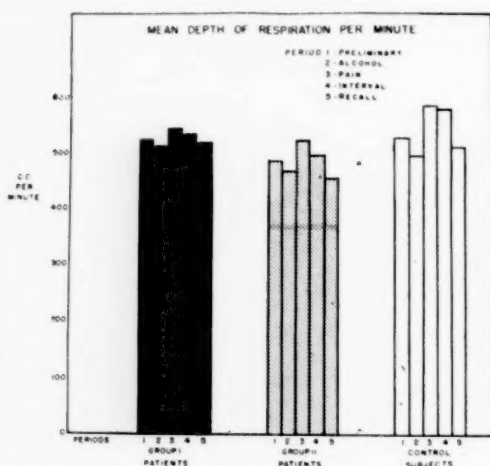


FIG. 8. Chart showing mean depth of respiration during each period for all experiments on patients and control subjects.

val. The increase in depth for the pain period and decrease for the recall period appear also in the selected summary for first experiments as well as in the separate summaries for Experiments A, B and C. Experiment C (7 tests) gives the most pronounced changes, with an increase of +39 cc. for the pain period and decreases of 64 and 106 cc. for the decrease in depth in the recall period when compared with the preliminary and the interval periods respectively.

(b) *Consistency.* The depth of respiration increased during the pain period in 15 of the 32 tests (47 per cent), in 8 of which the increase exceeded 100 cc. In 5 tests there was no appreciable change for pain, and in 12 tests (38 per cent) there was a decrease, which in only 2 cases exceeded 100 cc.

The depth of respiration increased during recall of pain in 13 out of 30 tests (43 per cent) in 5 cases of which the increase above the mean preliminary value exceeded 100 cc. In 8 tests (28 per cent) there was a decrease from the preliminary value which exceeded 100 cc. in 6 cases, and in one case was as much as one half liter. In 8 tests there was no appreciable change from the preliminary level. In only 10 of the 30 tests did the increase, lack of increase or decrease during pain coincide with a parallel change or lack of change for recall.

When the recall period is compared with the preceding interval, a decrease in depth appears for recall in 15 out of 30 tests (50 per cent), an increase in 10 tests (33 per cent) and no appreciable change in 10 tests. In just over one half of these cases the change or lack of change from the preliminary period coincides with a parallel change or with a lack of change from the interval period.

*Patients of Group 2. (a) Range and Summaries.* In the 14 tests on Group 2 patients, the mean depth of respiration ranged in each period from a low value of about 300 cc. to a high value of roughly between 600 cc. (recall period) to 950 cc. (alcohol period). The mean values for this group from the complete summary in Table 3 give a maximum of 526 cc. for the pain period, and a minimum of 458 cc. for the recall period, as compared with 490 cc. for the preliminary and 500 cc. for the interval periods. The increase for the pain period above the preliminary is 36 cc., and the decrease for recall below this level is 30 cc. A similar relation appears from the selected summary. The increase for the pain period in the summary for Experiment A (6 tests) is only 2 cc.; for Experiment B (6 tests) it is 46 cc.; and for Experiment C (2 tests) it is much greater, 103 cc. The decrease

for the recall period appears as about 40 cc. for both Experiments A and B. For the 2 tests in Experiment C there is an increase in depth of about 20 cc. for the recall period, when compared with both the preliminary and the interval periods.

(b) *Consistency.* The increase in depth during the pain period occurred in 10 of the 14 tests on Group 2 patients (70 per cent), and in 3 of these tests the increase exceeded 100 cc. In the 4 cases in which there was a decrease for pain, the decrease was always less than 100 cc. A decrease for the period of recall as compared with the preliminary occurred in 6 tests (43 per cent) and in 2 cases exceeded 100 cc. In 3 cases there was no appreciable change for recall and in 5 cases (35 per cent) there was an increase of less than 100 cc. Each of these 5 cases had also shown increase in depth for pain. A decrease for the recall period when compared with the preceding interval took place in 8 tests (57 per cent) in 3 of which the difference amounted to over 100 cc.

*Control Subjects.* (a) *Range and Summaries.* For the 23 experiments on 14 control subjects the depth of respiration ranged in each period from low values of about 300 cc. to high values which varied from less than 800 cc. to over 1100 cc. In the complete summary (Table 4) the largest values, 588 cc. and 582 cc., are those occurring during the pain and interval periods respectively, and represent the largest mean values for depth of respiration in the complete summary table for all periods and groups of subjects. The mean increase for the pain period over the preliminary period is 58 cc. The mean for the recall period is 14 cc. less than that for the preliminary period, and 66 cc. less than the mean for the preceding interval.

The increase in depth for the pain period obtains in each of the partial

summaries (Experiments A, B and C, and first experiments) but the increase is small for Experiment A (4 tests). The decrease in depth for the recall period appears in the summaries for Experiments A and C, the decrease from the mean for the preliminary level amounting in each case to about 30 cc. This decrease does not appear in the mean values for Experiment B, and is inconsiderable in the selected summary for first experiments.

(b) *Consistency.* The increase in depth of respiration for the pain period occurs in 15 of the 23 tests on the control subjects (65 per cent) and in 5 cases exceeds 100 cc. In 5 cases the depth for the pain period is less than during the preliminary period (in 1 case the difference is about 100 cc.), and in 3 cases there is no appreciable change in depth for pain.

The decrease in depth for the recall period as compared with the preliminary level appears in 9 of the 23 tests (40 per cent) and exceeds 200 cc. in 2 of these tests. An increase in depth for the recall period occurred in 8 tests (35 per cent), in only one of which the difference exceeded 100 cc. In the remaining 6 tests there was no appreciable change in depth for the recall period as compared with the preliminary period.

When the recall period is compared with the preceding interval instead of with the preliminary period, a decrease occurs in 16 of the tests (70 per cent) and amounts to over 100 cc. in 6 cases. In one of these cases the difference amounts to half a liter, and it exceeds 200 cc. in 2 other cases.

*Summary.* The mean values of the depth of respiration for each group of subjects show a tendency towards greater depth during pain, and there is a slight tendency towards a decrease in depth for the recall period. The increase in depth for pain appeared in only 47

per cent of the tests on Group 1 patients; it occurred for 71 per cent of the Group 2 patients and for 65 per cent of the control subjects.

The decrease for the recall period with respect to the preliminary period which was observed in the mean values actually occurred for less than half of the tests on each group of subjects (27 per cent for Group 1, 43 per cent for Group 2, and 40 per cent for the control subjects). In a considerable number of the tests there was little or no difference in depth of respiration for the recall period as compared with the preliminary period.

The depth for the recall period was less than that for the preceding interval in 50 per cent of the tests for Group 1, in 57 per cent of the tests for Group 2, and in 70 per cent of the tests on the control subjects.

#### MINUTE RESPIRATORY VOLUME

In Table 5 are given the values for the minute respiratory volume for each test. These values were determined by

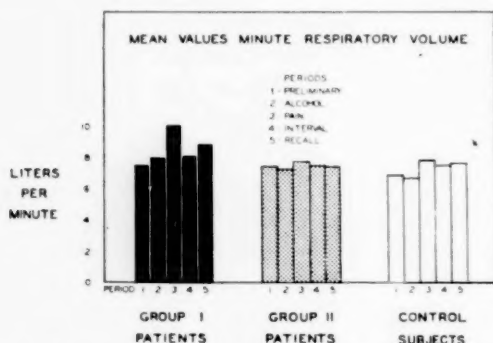


FIG. 9. Chart showing mean minute respiratory volume during each period for all experiments on patients and control subjects.

multiplying for each minute the rate by the corresponding mean depth, and averaging these values for each period. The values will not exactly correspond with the approximations that could be arrived at by multiplying the mean rates and mean depths for each period

that appear in Tables 1 and 3. The mean values for each group of subjects appear in Table 6. In considering the consistency of the changes involved,

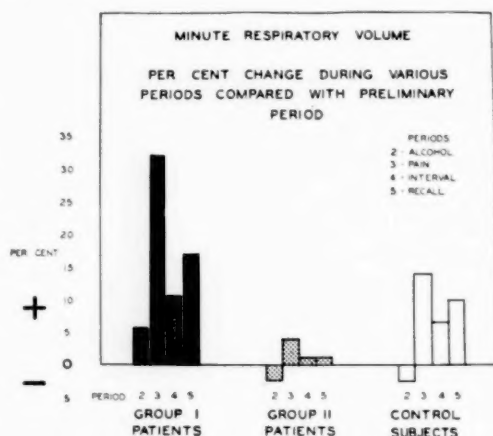


FIG. 10. Chart showing per cent differences in the mean values for minute respiratory volume of the alcohol, pain, interval and recall periods when compared with the preliminary period.

changes of 0.2 liter or less occurring between two periods in an individual test will arbitrarily be considered as no change in ventilation.

*Patients of Group 1. (a) Range and Summaries.* The minute respiratory volume for this group of patients ranged from 4.4 to 13.9 liters for the preliminary period (mean 7.6 liters, see complete summary section, Table 6), from 4.8 to 12.4 liters for the alcohol period (mean 8.0), from 4.8 to 19.1 liters for the pain period (mean 10.1 liters), from 4.5 to 15.4 liters for the interval period (mean 8.1 liters) and for the period of recall from 4.7 to 17.5 liters (mean 8.9 liters). The largest value occurs during the pain period with an increase of 2.4 liters or 31.6 per cent with respect to the preliminary period. The next largest value occurs during the period of recall with an increase over the preliminary value of 1.3 liters (17.1 per cent). The increases in minute respiratory volume for the pain and recall periods appear also in the summaries for Experiments A, B and C

TABLE 5  
MEAN TOTAL VENTILATION IN LITERS PER MINUTE FOR EACH PERIOD

No.	Preliminary		Alcohol		Pain		Interval		Recall	
	Duration of Period in Minutes	Average Minute Volume in Liters	Duration of Period in Minutes	Average Minute Volume in Liters	Duration of Period in Minutes	Average Minute Volume in Liters	Duration of Period in Minutes	Average Minute Volume in Liters	Duration of Period in Minutes	Average Minute Volume in Liters
Group I										
1	3	13.0	1	12.4	1	13.7	5	12.6	1	16.2
2	3	4.8	1	5.5	2	4.8	4	5.1	3	5.7
3	3	6.0	1	8.0	2	7.7	4	7.6	3	17.5
4	3	9.3	1	11.1	2	8.1	9	7.2	2	5.1
5	3	4.4	1	5.4	2	5.2	7	5.3	3	4.7
6	3	4.7	1	5.3	1	5.8	8	4.5		
7	3	5.3	1	4.8	1	8.1	9	6.1		
8	3	5.0	1	5.3	2	7.1	4	6.7	3	7.7
9	3	7.0	1	9.2	2	9.3	5	8.1	3	6.8
10	3	5.3	1	5.0	2	6.8	3	5.8	3	5.0
11#	3	7.1	1	8.0	2	8.8	5	6.5	3	8.3
12#	3	8.3	1	10.0	3	9.8	3	8.6	3	9.2
13#	6	6.6	1	7.2	3	7.0	4	6.8	3	6.6
14#	3	8.1	1	9.0	2	17.6	5	7.8	3	15.4
15#	3	5.6	1	5.3	3	6.9	5	5.5	3	5.2
16#	3	8.1	1	9.3	2	12.2	6	8.1	3	9.3
17#	3	8.7	1	8.7	3	9.7	5	9.2	3	9.2
18#	3	7.4	1	6.6	3	6.8	5	8.5	3	8.6
19#	3	12.7	1	10.7	2	17.5	4	12.7	3	9.0
19##	3	8.8			3	13.8	5	8.0	3	5.8
20#	3	9.8		10.4	3	8.9	5	11.5	3	11.2
21#	3	6.8	1	8.5	2	9.9	5	10.0	3	13.0
21##	3	6.7			3	13.4	5	7.5	3	14.9
22#	3	7.4	1	6.6	2	10.8	5	8.1	3	8.2
22##	3	8.3			3	8.9	5	9.4	3	8.4
23#	3	6.7	1	8.2	2	8.1	5	8.6	3	5.4
24##	3	8.6			3	8.8	5	8.2	3	8.1
24#	3	6.8	1	6.9	3	8.0	5	8.2	3	7.4
25#	3	8.5	1	10.8	3	16.5	5	7.0	3	10.1
25##	3	8.9			3	13.3	5	8.4	3	9.6
26##	3	5.2			3	7.3	5	6.9	3	6.8
27#	3	9.4			3	19.1	5	15.4	3	9.0
Group II										
28	3	6.8	1	8.4	2	7.8	11	7.7	3	7.2
29	3	5.1	1	4.6	2	4.7	5	5.2	3	4.9
30	3	4.0	1	4.8	1	5.8	3	4.7	2	4.6
31	3	5.4	1	5.3	2	5.2	5	5.3	3	4.9
32	3	5.2	1	5.6	1	5.3	4	4.1	3	4.5
33	3	9.7	1	8.4	2	8.1	6	10.3	3	11.5
34#	3	10.0	1	7.7	2	9.6	4	9.3	3	9.5
35#	3	8.6	1	9.3	3	9.2	4	8.9	3	8.9
36#	3	6.4	1	6.6	3	7.2	5	6.8	3	7.3
36##	3	6.5			3	7.6	5	7.1	3	7.7
37#	3	9.5	1	8.9	3	9.3	4	9.7	3	10.0
38#	3	8.5	1	8.2	3	9.3	5	8.9	3	8.4
38##	3	8.6			3	9.4	5	9.1	3	8.7
39#	3	9.3	1	9.4	2	10.0	5	8.9	3	7.6
Controls										
1	3	5.4	1	5.2	2	5.4	6	5.5	3	5.4
2	3	4.4	1	6.1	2	5.8	4	4.7	3	5.1
3	3	5.6	1	5.5	2	5.6	3	5.3	3	5.3
4	3	5.3	1	6.1	2	8.3	6	5.5	3	5.6
5#	3	9.0	1	8.9	3	10.0	5	9.2	3	9.3
5##	3	9.1			3	9.7	4	9.8	3	9.2
6#	3	7.7	1	6.9	3	8.2	5	8.5	3	7.4
6##	3	7.4			3	9.3	5	8.1	3	7.5
7#	3	9.3	1	10.3	3	8.9	5	8.9	3	8.3
8#	3	7.0	1	6.4	3	7.9	4	8.5	3	8.7
8##	3	8.6			3	9.6	4	8.7	3	9.1
9#	3	6.4	1	6.8	3	7.5	4	8.9	3	7.8
9##	3	7.6			3	7.8	5	10.2	3	8.6
10#	3	6.5	1	6.3	3	6.4	4	6.7	3	9.2
10##	3	7.4			3	7.6	5	8.0	3	8.6
11#	3	8.1	1	8.6	3	10.0	4	8.8	3	11.5
11##	3	8.9			3	12.7	5	7.6	3	6.9
12#	3	6.0	1	5.4	3	6.3	5	6.4	3	7.4
12##	3	6.2			3	6.8	5	6.1	3	7.6
13#	3	7.3	1	7.6	3	8.1	5	8.0	3	8.1
13##	3	7.1			3	8.5	5	7.7	3	7.0
14#	3	6.1	1	5.4	3	6.1	4	7.0	3	6.1
14##	3	5.5			3	6.4	5	5.2	3	6.1

Numbers marked # refer to Experiment B.  
Numbers marked ## refer to Experiment C.  
All other numbers refer to Experiment A.

TABLE 6  
MINUTE RESPIRATORY VOLUME  
Mean Total Ventilation During Each Period in Liters Per Minute

	Number of Experi- ments	Prelimi- nary Period	Alcohol Period	Pain Period	Interval Period	Recall Period	Increase with Respect to Preliminary Period	
							Pain	Recall
<i>General Summary</i>								
<i>Experiments A, B &amp; C</i> <i>(from Table 1)</i>								
All patients. . . . .	46	7.5	7.7	9.3	8.0	8.4	1.8	.9(.4)
Group 1. . . . .	32	7.6	8.0	10.0	8.1	8.9	2.4	1.3(.8)
Group 2. . . . .	14	7.5	7.3	7.8	7.6	7.6	.3	.1(0)
Controls. . . . .	23	7.0	6.8	8.0	7.5	7.7	1.0	.7(.2)
<i>Experiment A</i>								
Group 1. . . . .	10	6.8	7.3	7.7	6.9	8.6	.9	1.8(1.7)
Group 2. . . . .	6	6.2	6.2	6.2	6.2	6.3	0	.1(.1)
Controls. . . . .	4	5.2	5.7	6.3	5.3	5.4	1.1	.2(.1)
<i>Experiment B</i>								
Group 1. . . . .	16	8.0	8.4	11.1	8.9	9.1	3.1	1.1(.2)
Group 2. . . . .	6	8.7	8.4	9.1	8.8	8.6	.4	-.1(-.2)
Controls. . . . .	10	7.3	7.3	7.9	8.1	8.1	.6	.8(0)
<i>Experiment C</i>								
Group 1. . . . .	6	7.8		11.0	8.1	8.9	3.2	1.1(.8)
Group 2. . . . .	2	7.6		8.5	8.1	8.2	.9	.6(.1)
Controls. . . . .	9	7.5		8.7	7.9	8.3	1.2	.8(.4)
<i>Selected Summary</i>								
<i>First Experiment Only</i>								
Group 1. . . . .	27	7.4	8.0	9.7	8.1	8.8	2.3	1.4(.7)
Group 2. . . . .	12	7.5	7.3	7.6	7.5	7.4	.1	-.1(-.1)
Controls. . . . .	14	6.7	6.8	7.5	7.3	7.3	.8	.6(0)

Values in parentheses indicate the difference between the recall period and its preceding interval period.

and in the selected summary for first experiments. In Experiment A (10 patients) the mean value for the recall period is greater than that for the pain period, and the latter exceeds the preliminary value by only 0.9 liter or 13 per cent. This is to be compared with increases of 38.8 per cent for Experiment B (16 patients) and of 41 per cent for Experiment C (6 patients). The increase in minute respiratory volume for the period of recall appears in Experiments A and C to be substantiated by the fact that the mean value for this period also exceeds the mean for the preceding interval. This increase is 1.7 liters or 24.6 per cent for Experiment A and 0.8 liter or 9.9 per cent for Experiment C respectively. Experiment B, on the other hand, gives an increase of only 0.2 liter or 2.2 per cent for recall

as compared with the preceding interval.

(b) *Consistency.* The minute respiratory volume during the pain period exceeded the preliminary value in 26 out of the 32 tests on Group 1 patients (81 per cent), the mean value of this increase being 3.1 liters. In two tests there was a decrease (mean 0.9 liters) for the pain period, and in 4 tests there was no appreciable change.

Of the 24 tests showing increase for the pain period for which data on recall were available, 15 also showed a greater value for the recall period than for the preliminary period. In addition, 4 of the 6 tests giving no increase or a decrease for pain did give an increase for the period of recall, making a total of 19 tests (63 per cent) in which the recall period gave a larger value for total ven-

tilation than did the preliminary period. The mean value of this increase was 2.6 liters. A decrease from the preliminary level occurred in 9 tests (30 per cent) and no change in 2 tests. Distribution charts for the differences in minute respiratory volume between the pain and preliminary periods and between the recall and preliminary periods appear in Figs. 14 and 15. The significance of this apparent increase in ventilation during the recall period is lessened by the fact that in 7 of the 19 tests for which the recall value exceeded the preliminary level, there was either no appreciable difference in volume from the value of the preceding interval or there was a decrease from the value for the interval. In the tests in which the recall period showed a decrease or no change from the preliminary level a decrease or no change occurred also when the recall period was compared with the interval period. Hence in a total of only 12 out of 30 tests (40 per cent) on Group 1 patients for which recall data were collected, the total ventilation increased from the interval to the recall period. The mean value of this increase was quite considerable, however, amounting to 3.4 liters. There was an equal number of tests showing a decrease from the inter-

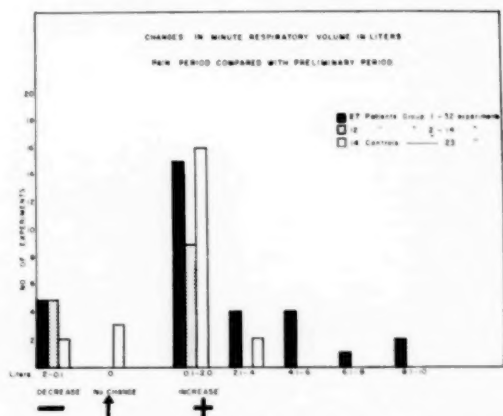


FIG. 11. Chart showing distribution of differences in minute respiratory volume between pain and preliminary periods for all experiments on patients and control subjects.

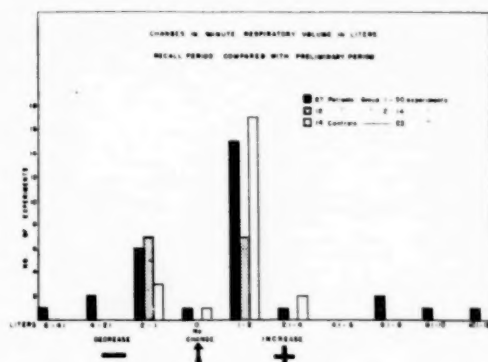


FIG. 12. Chart showing distribution of differences in minute respiratory volume between recall and preliminary periods for all experiments on patients and control subjects.

val to the recall period (mean change 1.9 liters) and 6 tests (20 per cent) gave approximately equal values for the two periods.

*Patients of Group 2. (a) Range and Summaries.* The minute respiratory volume in the 14 tests on 12 patients of Group 2 showed a closely comparable range of values for the 5 successive periods, and very little change in the successive mean values. For the preliminary period the range was from 4.9 liters to 10.0 liters (mean 7.5 liters, complete summary section, Table 6), for the alcohol period the range was 4.6 to 9.4 liters (mean 7.3 liters), for the pain period the range was 4.7 to 10.0 liters (mean 7.8 liters), for the interval period it was 4.1 to 10.3 liters (mean 7.6 liters) and for the recall period it was 4.5 to 11.5 liters (mean 7.6 liters). The mean increase for the pain over the preliminary period was only 0.3 liter in the complete summary, and in the four partial summaries it ranged between 0 and 0.9 liter. The mean difference between the recall and the preliminary periods was only 0.1 liter for the complete summary and for the partial summaries it ranged between -0.1 and +0.6 liter.

*(b) Consistency.* The patients of Group 2 appear very consistently to show little change in minute respiratory

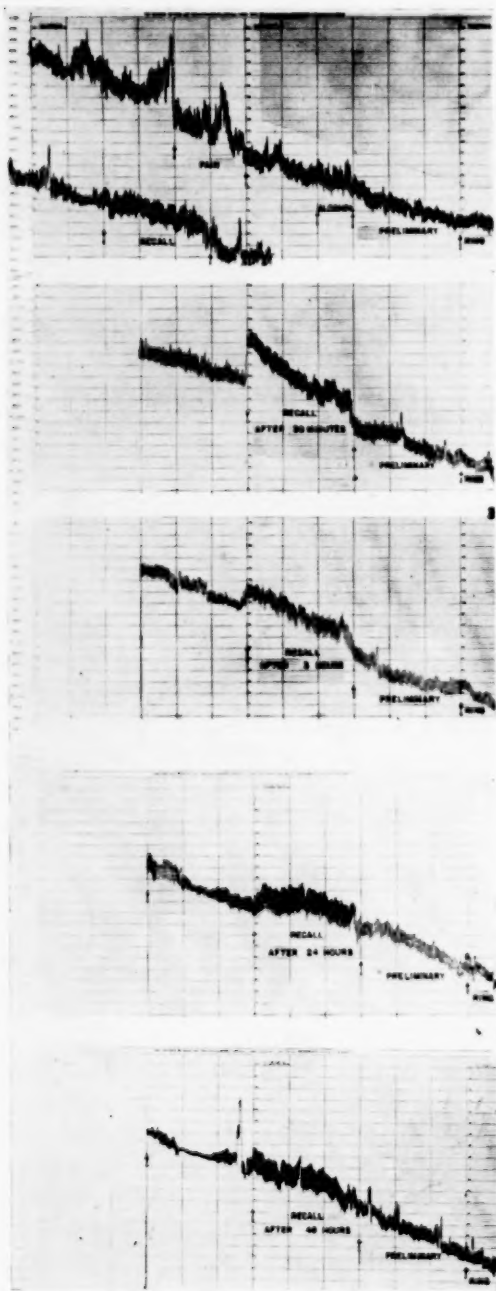


FIG. 13. Records of a series of experiments on a single patient No. 21. The uppermost record is the original experiment (Type B) with a recall period following 4 minutes after the end of the pain stimulus. The records below in order show a recall experiment after 30 minutes, after 3, 24, and 48 hours.

volume during the pain and recall periods. An increase for the pain period with respect to the preliminary period

appeared in only 8 of the 14 tests (57 per cent) and the increases involved ranged from 0.6 liter to only 1.1 liter. In 3 tests (21 per cent) there was a decrease and in 3 tests there was no appreciable change for pain. For the recall period there were 6 tests showing a higher value than for the preliminary period (mean difference 0.9 liter), there were 5 tests showing a lower value for the preliminary period (mean difference -0.7 liter) and in 3 tests there was no appreciable difference between the values for the two periods.

*Control Subjects. (a) Range and Summaries.* The minute respiratory volume for 23 tests on 14 control subjects ranged from 4.4 to 9.3 liters for the preliminary period (mean 7.0 liters), from 5.2 to 10.3 liters for the alcohol period (mean 6.8 liters), from 5.4 to 12.7 liters for the pain period (mean 8.0 liters), from 5.2 to 10.2 liters for the interval period (mean 7.5 liters) and from 5.1 to 11.5 liters for the recall period (mean 7.7 liters). The mean value in the complete summary is greatest for the pain period. The difference between the mean value for this period and that for the preliminary period is 1.0 liter (difference of 14 per cent). In each of the partial summaries the mean for the pain period exceeds that for the preliminary period, but the differences are small compared to those found for the Group 1 patients, and range from 0.6 liter for the 10 tests in Experiment B to 1.2 liters for the 9 tests in Experiment C. The mean value for the minute respiratory volume during the recall period is also slightly greater than that for the preliminary period. The difference amounts to only 0.7 liter (10 per cent) in the complete summary and varies for the partial summaries from 0.2 to 0.8 liter. The difference between the mean values for the recall and interval periods in the complete summary is only 0.2 liter.

*(b) Consistency.* The small increases

that appear from the mean values for the pain and recall periods for the control subjects occur with considerable consistency in the individual tests. In 16 of the 23 tests (70 per cent) there was an increase for the pain period. This increase never exceeded 3.0 liters, and had a mean value of 1.2 liters. A decrease from the preliminary volume occurred in only 1 case and in 6 cases (26 per cent) there was no appreciable change. The recall period showed a greater volume than the preliminary

a great difference between the range of response to recall in the two tests. For about half of the subjects the repeated tests gave closely comparable results for pain as well as for recall.

For one very reactive patient, No. 21, the recall period was repeated 4 times after the routine test (Experiment B) was terminated. These repeated tests took place respectively 30 minutes, 3 hours, 24 hours, and 48 hours after the first test. The respiratory tracings are presented in Fig. 11 and

TABLE 7  
MINUTE RESPIRATORY VOLUME IN LITERS  
*Repeated Tests for Recall on Patient, No. 21*

Date	Preliminary Period	Alcohol Period	Pain Period	Interval Period	Recall Period	Post-Recall Period
4-18-38.....	6.8	8.5	9.9	10.0	13.0	6.7
30 minutes later.....	5.9				11.9	6.4
3 hours later.....	6.0				12.4	6.3
4-19-38.....						
24 hours later.....	5.4				13.6	6.1
4-20-38.....						
48 hours later.....	8.8				14.5	6.2

period in 14 tests (61 per cent of the tests), the mean difference being 1.2 liters; it was slightly smaller than the preliminary value in only 3 cases, and in 6 cases (26 per cent) there was no appreciable difference. At the same time there does not appear to be any consistent difference between the recall and the interval periods; an increase of 1.1 liters appears for 39 per cent of the tests, a decrease of 1.1 liters for 22 per cent and no change for 39 per cent.

*Repeat Tests with Different Stimuli.* There were in all 16 subjects for whom both Experiments B and C are included in the data. Of these pairs of tests on the same individual, there were only 2 subjects, patient No. 21 and patient No. 22, who showed any considerable difference between the range of the increase in minute respiratory volume for the two pain stimuli. There was only one subject, control No. 8, who showed

the data for minute respiratory volume are shown in Table 7.

In this experiment there was an increase in minute respiratory volume of 46 per cent during the pain period. This increase was sustained during the interval period. During the recall period the volume increased still further to a value exceeding the preliminary period by 91 per cent and exceeding the interval by 30 per cent. It is interesting to note the abrupt fall in minute respiratory volume to the preliminary level immediately after the recall period (post-recall) when the patient was instructed to think of anything that came to mind. Thirty minutes later her minute respiratory volume during a preliminary period was about the same as in the original preliminary period, and it rose by 101 per cent when asked to recall the previous painful experience. Again it fell in the post-recall period to a level

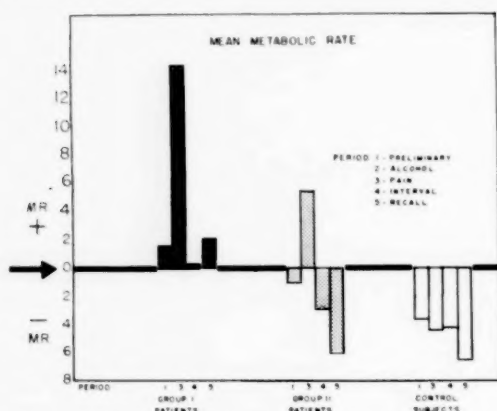


FIG. 14. Chart showing mean values for metabolic rate during each period for all experiments on patients and control subjects.

approximating that of the preliminary period. Similarly increases of respectively 105 per cent, 153 per cent and 77 per cent occurred in the 3 successive tests (including the test made after 48 hours), and in each case there was a prompt return in the post-recall period to a level approximating the preliminary value. In spite of the great reactivity of the patient, 4 of the preliminary, and all 5 of the post-recall periods showed a striking constancy in minute respiratory volume.

**Summary.** A large increase in minute respiratory volume for the pain period as compared with the preliminary period appeared consistently for Group 1 patients. Of 32 tests, 81 per cent showed increases which averaged 3.1 liters. In the control group an increase in minute respiratory volume was also observed in the majority of cases (70 per cent), but the individual changes were smaller, the mean difference being 1.2 liters.

During the recall period the minute respiratory volume of the patients of Group 1 was in most cases greater than during the preliminary period, a mean increase of 2.6 liters appearing for 63 per cent of the tests on this group. A mean increase of 1.2 liters for the recall period over the preliminary pe-

riod appeared in 61 per cent of the control tests.

Patients in Group 2 consistently showed little change in minute respiratory volume during the pain and recall period as compared with the preliminary period.

Repeated tests with different stimuli on the same individual yield closely comparable changes in minute respiratory volume.

#### METABOLIC RATE

Metabolic rates were derived for the preliminary, pain, and recall periods from all the respiratory tracings available even when these periods lasted 2 or 3 minutes instead of 6 minutes, the routine interval for measurement of basal metabolism. Since most of the periods lasted 3 minutes the values for these periods must be considered as less reliable than those for the 6 minute period. It was felt worth while to include a summary table for metabolic rate.

**Patients and Controls. (a) Range and Summaries.** The values for all the experiments of Group 1 ranged from -22 to +88, for Group 2 from -29 to +22, and for the controls from -28 to +33. The mean values (see Table 8) for the preliminary period are +1.6 for Group 1, -1.3 for Group 2, and -3.7 for the control subjects. All these values are well within the normal range of variation.

For the pain the average value for all of the experiments of Group 1 is +14.4 which value is somewhat above the normal range and which indicates an average increase of 12.8. For all experiments of Group 2 and of the control subjects the change from the pain to the preliminary period was +5.4 and -4.4 respectively. Both of these changes are within the normal range. The values for the recall period averaged for all the experiments are within the normal range.

In the summaries of Experiments A, B and C and the selected summary table the differences in the metabolic rate between the pain and the preliminary period are greater than +10 per cent for Group 1 in Experiments A, B and C and for Group 2 in Experiment A. The values for first experiments

(b) *Consistency.* When the individual tests are examined instead of the group averages, an increase in metabolic rate averaging +22 per cent appears for 62 per cent of the Group 1 tests, an increase of +18 per cent appears for 58 per cent of the Group 2 tests, whereas an increase of +8 per

TABLE 8  
METABOLIC RATE  
Mean Metabolic Rate During Each Period in Per Cent

	Number of Experi- ments	Prelimi- nary Period	Pain Period	Interval Period	Recall Period	Increase with Respect to Preliminary Period	
						Pain	Recall
<i>General Summary</i> <i>Experiments A, B &amp; C</i> <i>(from Table 1)</i>							
All patients.....	46	+ .8	+11.8	- 1.1	- .5	+11.0	-1.3(+.6)
Group 1.....	32	+1.6	+14.4	- .3	+ 2.1	+12.8	+ .5(+2.4)
Group 2.....	14	-1.3	+ 5.4	- 3.0	- 6.1	+ 6.6	-4.9(-3.1)
Controls.....	23	-3.7	- 4.4	- 4.3	- 6.6	- .7	-2.9(-2.3)
<i>Experiment A</i>							
Group 1.....	10	-5.7	+ 5.1	- 1.5	+ 3.9	+10.8	+9.6(+5.4)
Group 2.....	6	-3.0	+11.8	- 4.3	- 2.0	+14.8	+1.0(+2.3)
Controls.....	4	-2.3	- .8	- 1.3	- 4.8	+ 1.5	-2.5(-3.5)
<i>Experiment B</i>							
Group 1.....	15	+5.2	+18.4	- .5	+ 1.5	+13.2	-3.7(+2.0)
Group 2.....	6	+1.2	+ 6.3	+ 1.7	- 8.0	+ 5.1	-9.2(-9.7)
Controls.....	10	-7.2	- 8.1	- 9.9	-11.2	- .9	-4.0(-1.3)
<i>Experiment C</i>							
Group 1.....	7	+4.6	+15.3	+ 2.0	+ 1.6	+10.7	-3.0(-.4)
Group 2.....	2	-3.5	-10.0	-10.0	-13.0	- 6.5	-9.5(0)
Controls.....	9	- .6	- 2.0	+ .7	- 2.3	- 1.4	-1.7(-3.0)
<i>Selected Summary</i> <i>First Experiment Only</i>							
Group 1.....	27	+1.8	+15.6	+ .2	+ 1.8	+13.8	0(+1.6)
Group 2.....	12	- .9	+ 8.5	- 1.3	- 5.0	+ 9.4	-4.1(-3.7)
Controls.....	14	-5.8	- 6.0	- 7.4	- 9.4	- .2	-3.6(-2.0)

Values in parentheses indicate the difference between the recall period and its preceding interval period.

show a mean increase during pain of +13.8 per cent.

In no group or series of experiments did the recall period show an increase in metabolic rate greater than +10 per cent. In Experiment A the mean increase for Group 1 was +9.6, and in Experiment B and Experiment C the Group 2 patients showed a decrease during the recall when compared with preliminary of -9.2 and -9.5 respectively.

cent appears for only 35 per cent of the controls, for whom a slightly larger number show equivalent small decreases in rate. Hence both groups of patients, but more especially Group 1, show a somewhat consistent trend toward increase in metabolic rate during pain, in contrast to the controls, who show little or no change during pain.

Of the Group 1 patients, 45 per cent showed some increase in metabolic rate

TABLE 9  
MEAN EXPIRATORY-INSPIRATORY ANGLE FOR PRELIMINARY, PAIN AND RECALL PERIODS

No.	Preliminary		Pain		Recall	
	Duration of Period in Minutes	Average E-I Angle	Duration of Period in Minutes	Average E-I Angle	Duration of Period in Minutes	Average E-I Angle
Group I						
1	3	5.3	1	4.0	1	4.0
2	3	0.7	2	0.0	3	5.8
3	3	9.5	2	5.8	3	3.8
4	3	4.5	2	3.8	2	4.4
5	3	0.2	2	4.4	3	5.0
6						
7						
8	3	7.5	2	4.5	3	5.0
9	3	4.8	2	4.0	3	4.8
10	3	4.2	2	4.5	3	4.8
11#	3	5.0	1	4.1	3	5.4
12#	3	5.4	3	5.5	3	5.5
13#	6	0.4	3	5.7	3	5.9
14#	3	5.4	2	3.5	3	3.4
15#	3	0.1	3	5.3	3	5.1
16#	3	4.0	2	3.7	3	4.7
17#	3	3.0	3	3.5	3	3.7
18#	3	4.8	3	4.2	3	4.2
19#	3	4.4	2	3.8	3	5.8
19##	3	5.2	3	5.2	3	0.1
20#	3	5.0	3	4.0	3	4.5
21#	3	3.8	2	4.0	3	3.5
21##	3	3.0	3	3.5	3	3.4
22#	3	5.6	2	3.9	3	5.8
22##	3	5.0	3	4.8	3	5.3
23#	3	3.0	2	3.8	3	4.3
23##	3	3.8	3	4.2	3	3.8
24#	3	3.0	3	2.0	3	2.0
25#	3	5.4	3	3.0	3	3.8
25##	3	5.3	3		3	3.7
26##	3	5.1	3	3.7	3	3.7
27##	3	4.7	3	3.8	3	4.3
Group II						
28	3	5.3	2	5.1	3	4.7
29	3		2		3	
30	3	5.4	1	5.1	2	4.7
31	3	4.3	2	4.4	3	3.7
32	3	0.1	1	0.5	3	5.9
33	3	4.7	2	4.4	3	4.3
34#	3	5.2	2	5.2	3	5.4
35#	3	3.7	3	4.2	4	3.7
36#	3	3.8	3	5.0	3	4.2
36##	3	5.2	3	4.1	3	4.3
37#	3	4.0	3	4.3	3	3.0
38#	3	3.5	3	3.4	3	3.5
38##	3	4.3	3	3.9	3	4.1
39#	3	5.3	2	5.3	3	5.4
Controls						
1	3	4.7	1	4.5	3	5.2
2	3	0.0	2	5.5	3	5.0
3	3	4.9	2	5.2	3	4.0
4	3	5.0	2	4.4	3	5.2
5#	3	4.7	3	4.4	3	4.4
5##	3	4.3	3	3.5	3	3.3
6#	3	9.0	3	7.8	3	8.0
6##	3	8.1	3	5.1	3	0.7
7#	3	5.4	3	4.5	3	4.4
8#	3	5.2	3	4.4	3	4.2
8##	3	4.6	3	4.3	3	4.1
9#	3	0.1	3	5.0	3	4.5
9##	3	5.2	3	4.8	3	5.3
10#	3	0.0	3	5.0	3	4.7
10##	3	5.2	3	5.3	3	5.1
11#	3	4.3	3	4.1	3	4.4
11##	3	4.3	3	4.1	3	4.2
12#	3	4.1	3	4.0	3	3.8
12##	3	3.8	3	4.0	3	3.9
13#	3	5.1	3	4.2	3	5.0
13##	3	4.7	3	3.7	3	4.0
14#	3	4.3	3	4.5	3	4.7
14##	3	5.3	3	4.8	3	4.3

Numbers marked # refer to Experiment B.  
Numbers marked ## refer to Experiment C.  
All other numbers refer to Experiment A.

TABLE 10  
EXPIRATORY-INSPIRATORY ANGLE  
Mean Value for Each Period

	Number of Experi- ments	Preliminary Period	Pain Period	Recall Period	Increase with Respect to Preliminary Period	
					Pain	Recall
<i>General Summary Experiments A, B &amp; C (from Table 1)</i>						
All patients.....	43	5.1	4.5	4.6	— .6	— .5
Group 1.....	30	5.2	4.3	4.6	— .9	— .6
Group 2.....	13	4.9	4.7	4.4	— .2	— .5
Controls.....	23	5.3	4.7	4.9	— .6	— .4
<i>Experiment A</i>						
Group 1.....	8	6.1	4.9	5.0	— 1.2	— 1.1
Group 2.....	5	5.8	5.1	4.7	— .7	— 1.1
Controls.....	4	5.3	4.9	4.9	— .4	— .4
<i>Experiment B</i>						
Group 1.....	15	4.9	4.1	4.6	— .8	+ .5
Group 2.....	6	4.3	4.7	4.3	+ .4	0
Controls.....	10	5.5	4.9	4.9	— .6	— .6
<i>Experiment C</i>						
Group 1.....	5	4.7	4.2	4.3	— .5	— .4
Group 2.....	2	4.8	4.0	4.2	— .8	— .6
Controls.....	9	5.1	4.4	4.9	— .7	— .2
<i>Selected Summary First Experiment Only</i>						
Group 1.....	25	5.3	4.4	4.7	— .9	— .6
Group 2.....	11	4.9	4.9	4.5	0	— .4
Controls.....	14	5.4	4.9	4.9	— .5	— .5

Values in parentheses indicate the difference between the recall period and its preceding interval period.

for recall, the mean increase for these individuals being +97 per cent. Hence the change for recall is considerably less than the change for pain. Only 1 patient of Group 2 showed an increase for recall. Of the control tests only 26 per cent give a high metabolic rate for the recall as compared with the preliminary periods.

*Summary.* The data suggest that the patients and most especially those of Group 1 show an increase in metabolic rate on pain stimulation and no change during the recall of this experience.

#### EXPIRATORY-INSPIRATORY ANGLE

The values for the mean E-I angle, which is an arbitrary measure of the abruptness of the shift from the expiratory to the inspiratory phase of the

tracing, are presented in Table 9.<sup>4</sup> The values for the preliminary, pain and recall periods represent the mean E-I angles for each period. The average of these mean E-I angles are presented for the two groups of patients and for the controls in Table 10.

*Patients and Controls. (a) Range and Summaries.* The range of mean values for all the periods of Group 1 was 2.9 to 9.5. For Group 2 the range was from 3.4 to 9.1, and for the controls was from 3.3 to 9.5. The range was somewhat greater for Group 1. The mean values

<sup>4</sup> From the distribution of the expiratory-inspiratory angles found in the respiratory tracing for each period a mean expiratory-inspiratory angle was calculated for each period for each experiment. The mean expiratory-inspiratory angle thus obtained should not be confused with the group mean values, which in turn were derived from the individual mean values.

for the preliminary period were highest for the controls (5.3) and least for Group 2 (4.9). All of the groups had smaller mean values (more acute angles) for the pain period, the greatest decrease (.9) being seen in Group 1. All groups also had sharper angles for the recall period when compared with the preliminary period. Group 2 showed sharper angles for the recall than for the pain period. The mean group differences for the different periods are not great.

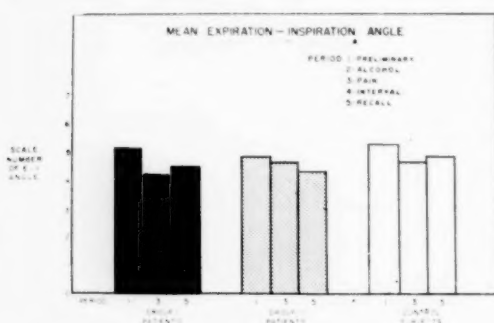


FIG. 15. Chart showing mean values for expiratory-inspiratory angle during each period for all experiments on patients and control subjects.

A decrease in mean E-I angle (sharper angles) for the pain period is seen in all groups for Experiments A, B and C and the selected summary with the exception of Group 2, Experiment B, where the value for pain is greater, and for Group 2 in the selected summary where the value is the same as the preliminary value. The mean value for recall is also less than the preliminary value for all groups in Experiments A, B and C and in the selected summary with the exception of Group 1, Experiment B, where it is .5 greater for recall, and Group 2, Experiment B, where there is no change.

(b) *Consistency.* Of 29 tests on patients of Group 1, 22 (76 per cent) showed a mean shift of 1.1 scale numbers to more acute angles during pain and 21 (70 per cent) showed a similar shift (.9 scale numbers) during recall,

whereas, there were only two cases in which a broader mean angle occurred in pain and in recall than in the preliminary period. The slight shift to more acute angles for Group 2 occurs in scarcely more than half of the individual tests (54 per cent). An equivalent shift toward broader angles occurred for about one third of the group. Hence the mean values for pain differ slightly from the preliminary value for this group.

Of 23 tests for the control group a shift toward more acute angles in the pain period occurred in 19 tests (83 per cent), in 17 tests (74 per cent) for the recall period, and in 15 tests for both pain and recall. There were only two tests in which both pain and recall periods showed broader angles than the preliminary period.

*Summary.* About 75 per cent of the experiments in Group 1 and in the control series showed a small shift toward smaller (more acute angles) values during the pain and recall periods. In over half of the experiments of Group 2 there was a decrease in mean E-I angle seen during the pain and recall periods. Of the 22 tests on Group 1 patients, in which a shift in E-I angle occurred, an increase in rate of respiration also took place in 18 cases. In 4 tests an average shift of .9 took place without an increase in rate of respiration. In 4 cases of Group 2 there was an average shift of 1.1 towards sharper angles accompanied by a decrease in respiratory rate.

## DISCUSSION

1) A consideration of the data shows a definite and consistent increase in minute respiratory volume during the painful stimulation, with less consistent changes in the component functions, rate and depth of respirations. Rate of respiration correlates fairly closely with minute respiratory volume. The increase in total ventilation that accom-

panied the stimulus was brought about most frequently by more rapid breathing, which in some cases was accompanied by deeper breathing and in some cases in spite of shallower breathing. Although the least degree of consistency appears for the changes in depth, rate alone does not completely parallel the changes in minute respiratory volume. Hence it seems that the more significant respiratory function for study in connection with emotional and sensory changes is the product of rate and depth, namely total ventilation. It is striking that the best correlation appears for the function which should logically be involved, namely the total ventilation, however this may be brought about in the individual case. The contradictions found in the literature concerning the effect of various stimuli upon either rate or depth of breathing (1, 4, 6, 7, 8, 12) can thus be in part accounted for. The present findings are in agreement with those from the study on the effect of an unpleasant ideational stimulus where the most consistent changes were seen for minute respiratory volume.

2) The increase in ventilation during a sensory stimulus does not occur in every individual. It was found to occur most frequently and most markedly in patients of the arbitrary diagnostic group (hysteria, anxiety neurosis, and phobia) for whom a mean increase in minute respiratory volume of 3.1 liters was found in 81 per cent of the cases. This compares with the data of the previous study in which a mean increase of 2.1 liters was found in 89 per cent of a similar diagnostic group, composed of 29 patients only 5 of whom were included in Group 1 of the present study.

In the second diagnostic group (hypochondriasis, reactive depression, compulsion neurosis, and questionable schizophrenia) the increase in minute respiratory volume appeared less fre-

quently and the individual reactions were less pronounced. An average increase of 0.8 liter in 57 per cent of the patients of this group during pain found in the present study is to be compared with the average increase of 0.4 liter found in the previous study in 50 per cent of the patients of Group 2 during an unpleasant ideational stimulus. Of this previous Group 2, only 1 individual was included in the present study.

Of the control subjects 70 per cent in the present study reacted to the pain with a mean increase in minute respiratory volume of 1.2 liters. In other words, in consistency and in intensity of reaction they fall in between the two groups of patients. Of the controls in the previous study, 75 per cent showed an increase in minute respiratory volume exceeding  $\pm 0.2$  liter, the mean increase being 0.9 liter.

In view of this variability it is important to include in studies of this sort sufficiently large numbers of subjects. Some of the confusion in the literature on the subject of respiratory response to ideational stimuli undoubtedly arises from an attempt to correlate findings from two or three cases.

3) In studying the effect of recall of the pain, the minute respiratory volume (as well as the other respiratory functions) were compared with the preliminary value in order that the change involved might be then compared with that obtained for the pain. On this basis the mean values for the groups show some increase in minute respiratory volume for recall as compared with the preliminary period for Group 1 and for the controls. A change in this direction appeared for about 60 per cent of each group, the mean value of this change amounting to  $+2.6$  liters for Group 1, and to  $+1.2$  liters for the controls. For the Group 2 patients only 43 per cent showed a greater total ventilation during recall than during the pre-

liminary period, and the mean for this increase was 0.9 liter. The proportion of individuals that had shown an increase in minute respiratory volume for unpleasant ideas in the previous study was higher for each of the three groups.

When the recall period is compared with its preceding interval period, a still smaller proportion of individuals (about 40 per cent for each group) shows an increase in minute respiratory volume for recall, whereas about 60 per cent show no change or show a decrease. This difference, between the effect of the unpleasant memories and fantasies in the first paper and the recall of a current painful situation in this paper, may have been due to the effect of the intervening pain period in the present study, the effect of which might not have worn off so that a base line could be attained before the recall period. The time that elapsed between the end of the pain period and the start of the recall period ranged from 3 to 11 minutes, but in most cases it was 5 minutes. In the previous study no time elapsed between the end of the unpleasant period and the start of the subsequent second pleasant period. Nevertheless the minute respiratory volume for the second pleasant period did not appear to have been unduly influenced by the high value for the preceding unpleasant period, since lower values were obtained in a large number of cases for this pleasant period than for the preliminary period. It may be that a longer interval after the pain is needed to recover from the current pain stimulus than from the unpleasant ideas. This question requires further study. It should be noted in this connection that the mean value for the minute respiratory volume during the interval period was greater for each group of subjects than the mean value for the preliminary period.

Increase in minute respiratory vol-

ume can obviously be brought about by a number of differently combined changes in the component factors, rate, and depth.

In many cases the increase observed during pain and recall occurred by increase in rate with some increase in depth. There are, however, examples in the data of the other combinations such as increase in depth without much change in rate or with decrease in rate. This combination appeared for most of the Group 2 patients during the pain stimulus, and for many of the control tests. In most of the cases in which Experiments B and C were carried out on the same individual, the changes in minute respiratory volume during pain and recall are roughly the same in the two experiments, but the way in which this change is brought about is not always the same. Patient No. 21, for example, had in both tests a marked increase in minute respiratory volume during pain which in Experiment B was brought about by increase in depth in spite of decrease in rate, and in Experiment C was brought about by a great increase in rate with less increase in depth. Similarly for control 11, an increase in minute respiratory volume during pain was brought about in Experiment B by increase in rate without change in depth, and in Experiment C by increase in depth without change in rate.

The increase in metabolic rate during pain which appears consistently for the patients of Group 1 in Experiments A, B and C, represents a greater change than appeared in the previous study for changes brought about by unpleasant ideas (2, see also 5, 11). This increase, which appears in the present study also for many of the Group 2 patients, is consistently lacking for the control subjects in Experiments A, B and C.

In general the acuteness of the mean

expiratory-inspiratory angles is related to the rate of respiration in the obvious sense that the slower the rate, the more broad angles appear and vice versa. At the same time there are a number of cases in which changes in the angle occur independently of changes in rate.

An attempt was made to keep the pain stimulus constant. Yet it is quite clear that the intensity of the stimulus perceived varied from individual to individual. In Experiments A and B the same skin area was selected for puncture by the needle but no attempt was made to select comparable pain spots for stimulation. In experiment C local factors such as differences in skin resistance, differences in area of the finger tip in contact with the electrode, may have made the actual effective current used different from individual to individual. Yet all the subjects reported having experienced pain and there was little difference in the description of the sensations from individual to individual.

The difference in reaction observed in the various groups of subjects is on the whole similar to that found in the study on the effect of ideational stimuli. These results are also in keeping with the study of Whitehorn and Richter (10) on the beat to beat variability of the heart rate in psychoneurotic patients during an interview. The present study shows a greater reactivity to pain stimuli and to the recall of these stimuli in Group 1 patients than in the normal control subjects. The control subjects in turn showed a greater reactivity than did patients in Group 2. The reasons for these differences are at present not clear and their elucidation must be reserved for further studies.

#### SUMMARY

1) Respiratory tracings were obtained on a series of 39 psychoneurotic patients and 14 control subjects during

the administration of a painful stimulus and during the subsequent recall by the patient of this experience.

2) The respiratory records were analyzed period by period for rate and depth of respiration, minute respiratory volume, metabolic rate and expiratory-inspiratory angle.

3) As a result of a previous study the patients were divided on the basis of hospital diagnosis into two groups. Group 1 included 27 patients diagnosed as hysteria, phobia or anxiety neurosis. Group 2 included 12 patients diagnosed as hypochondriasis, reactive depression, compulsion neurosis or questionable schizophrenia.

4) Most of the patients of Group 1 showed during pain an increase in rate, in minute respiratory volume, and in metabolic rate, as well as a shift towards sharper expiratory-inspiratory angles. During recall there was an increase in minute respiratory volume which was not great or as consistent as during the pain period.

5) Patients of Group 2 showed during pain little or no change in rate. They showed an increase in depth of respiration, and correspondingly a small increase in minute respiratory volume. The changes in metabolic rate and in expiratory-inspiratory angle were not consistent. During recall there was some increase in rate, no consistent change in depth, or in minute respiratory volume. The metabolic rate decreased slightly in most cases for recall, and the expiratory-inspiratory angle was more acute.

6) A majority of the control tests showed during pain an increase in depth of respiration, and a moderate increase in minute respiratory volume. There was no increase in metabolic rate. The expiratory-inspiratory angles became more acute. During recall there was some increase in rate of respiration, and again in the majority of cases an

increase in minute respiratory volume. Metabolic rate decreased slightly in most cases for recall and the expiratory-inspiratory angles became more acute.

#### SUMMARY OF CASE HISTORIES

*Case 1.*—F.A., a 23-year-old, single, Italian school teacher complains of weakness of the face and extremities, fleeting paralysis of extremities, most markedly of right leg. The left hand and forearm are held in contracture. Patient also mentions feelings connected with palpitation, being upset, feelings of inadequacy. Physical examination showed obesity, contracture of left hand, forearm and arm, anesthesia to pain and touch left hand, forearm and arm, left foot, leg and thigh. Gait drags, left leg draws weight. Lumbar puncture negative. Sugar tolerance normal. B.M.R.  $-15$  to  $+15$ .

Diagnosis: Hysteria.

*Case 2.*—T.C., a 26-year-old, white, native born, married housewife complains of palpitation, heart pounding associated with gastrointestinal symptoms of 15 years' duration. During these attacks she feels weak, nauseated, has alternating sensations of hot and cold and sometimes vomiting and diarrhea. The duration of the attack varies from a few minutes to hours. Physical examination was essentially negative. Marked autonomic instability. X-ray of chest and E.K.G. essentially negative. B.M.R.  $-4$ .

Diagnosis: Anxiety neurosis.

?Paroxysmal tachycardia.

*Case 3.*—C.D., a 29-year-old, white, single, native born male complaining of attacks of palpitation, tingling and numbness in his calves, tight sensations in his head of six years' duration. During these attacks he becomes fearful and thinks that he might fall in the street. These attacks come on almost every week and at times even more frequently. He is readily upset especially by ideas of death and illness. The attacks have been increasing in severity until at present he is unable to continue with his work. The physical examination was negative except for a fine tremor of the outstretched hands. Laboratory examina-

tion including electroencephalogram, x-rays of the chest and skull, glucose tolerance test, B.M.R., were all within normal limits.

Diagnosis: Anxiety neurosis.

*Case 4.*—I.D., a 26-year-old, white, native born, single female was admitted for sneezing and vomiting of about two weeks' duration. The sneezing had started four years previously after an appendectomy. The patient also complained of weakness, headache and occasional episodes of palpitation. Physical examination showed marked tremor of the eyelids with presence of apical systolic murmur and undernourishment. Laboratory examination including x-rays of chest, sinuses and G.I. tract were essentially normal.

Diagnosis: Hysteria.

*Case 5.*—M.E., a 19-year-old, white, native born, female college student complaining of feelings of tension, jitteriness, "feelings that something is wrong," and occasional palpitations of two months' duration. Onset in connection with school examinations and feelings of inadequacies in studies. Crying episodes with mild depressive feelings. Physical examination negative.

Diagnosis: Anxiety neurosis.

*Case 6.*—M.F., a 23-year-old, white, native born, single female complains of seizures of two years' duration. The onset of the seizures followed an accident in which the patient was almost drowned. In addition the patient has had episodes in which she has had palpitation, shortness of breath and feelings of anxiety. Physical examination showed moderate tremor of tongue, right knee jerk greater than left. X-ray of skull plates showed slight increase of the convolutional markings. Air encephalogram showed moderate amount of generalized brain atrophy. The fits occur when the patient is worried, when she is disturbed, thinking about the boat incident, when excited, fatigued or having her period.

Diagnosis: Epilepsy, grand mal seizures.  
Anxiety neurosis.

*Case 7.*—F.I., a 26-year-old, unmarried, native born male complaining of dizziness

and loss of vision of four weeks' duration. The difficulty in vision consisted in the patient's having monocular diplopia, which would shift to a blurring of vision which in turn would shift to a complete blindness. The patient finds that placing his finger inside the front part of the left ear and holding it there makes his vision much clearer and the diplopia disappears. The patient had a history of chronic labyrinthitis with dizziness dating back six years. He has had several mastoidectomies with no relief. He had a low grade meningitis four years ago which subsided in three to four days. Physical examination showed a lateral rotary nystagmus, tubular visual fields. The left pupil reacts poorly to light. Complete dizziness in the right ear. Right biceps and knee jerks greater than left. Right positive Babinski and Chaddock. Fine tremor of outstretched hands. X-ray of skull shows sclerose mastoid on right. B.M.R. -19 to -7.

Diagnosis: Hysteria.

Central nervous system trauma.

*Case 8.*—M.S., a 24-year-old, white, single, native born female complaining of laughing, crying, fatiguability of several months' duration. Has always been frigid and showed a marked tendency toward dramatization. Patient had a considerable push of speech and talked freely about her intimate affairs. Physical examination negative.

Diagnosis: Hysteria.

*Case 9.*—R.S., a 17-year-old, unmarried, white, native born girl complaining of a marked tremor of the right leg, pain in the back of fifteen months' duration following a fall in which she twisted her back. In addition there were marked spasms of her legs in which they would be drawn up. After the fall the legs were put in casts during which time the patient suffered acute pain in her back. Physical examination showed marked tremor of right leg, 7 per second, which increased on emotional excitement, muscular spasm to light palpitation over L 3, 4, 5 and sacrum and thigh sacro iliac junction. Question of hypesthesia over right leg and foot, marked irregular

clonus right ankle, slight clonus of left ankle, marked blushing, sweaty hands.

Diagnosis: Hysteria.

*Case 10.*—H.S., a 31-year-old, single, native born, white male lawyer complains of feelings of tension, difficulty in breathing, and occasional attacks of palpitation for the last six years. During the last year the attacks of palpitation and dyspnea have been coming on more frequently. During the last year patient has noticed more marked feelings of inadequacy in connection with work. Physical examination negative. B.M.R. +4.

Diagnosis: Anxiety neurosis.

*Case 11.*—This patient is described in the text.

*Case 12.*—J.V., a 26-year-old, Italian, single, male complains of nervousness, shortness of breath, palpitation, pains around the head and in back of the neck of seven months' duration. He also has a feeling of numbness about the left shoulder and left thoracic region. During the course of treatment he mentioned having headaches, smothering sensations running through his head, peculiar sensations in the left chest and pain and itching sensations in the left leg. Physical examination was negative except for the variable left abdominal reflex. Chest plate negative. E.K.G. negative.

Diagnosis: Anxiety neurosis.

*Case 13.*—R.R., a 31-year-old, white, native born, single female complains of pains in hands and feet of eight years' duration. She also complains of feelings of lassitude and fatigue. Physical examination showed moderate deformity with swelling and redness of all the metacarpal phalangeal and interphalangeal joints. There was moderate limitation of motion. Neurological examination showed diminished corneal reflexes bilaterally, anesthesia to pin prick, cold, and touch over the face and scalp, the right side of the back from the mid-line to the mid-axillary line and from the upper border of the scapula to the inferior natal fold. The same type of anesthesia was present over both arms below the elbows and both legs below the knees. Laboratory

examination showed a sedimentation rate of .63 mm. per minute. Uric acid 3.4 per 100 cc. E.K.G. and electroencephalogram were within normal limits. B.M.R. ranged from +47 to -8. X-rays of the hand showed slight narrowing of the phalangeal joints, slight generalized atrophy but no evidence of bone destruction or of bone formation.

Diagnosis: Rheumatoid arthritis.  
Hysteria.

*Case 14.*—M.C., a 42-year-old, married, native born female who was seen at the Massachusetts General Hospital complaining of feeling that something was about to happen. She knew it was silly, but could not do anything about it. She also complained of pain in the chest which gripped her and made her feel weak, and of general weakness. She said that she could not go to church because when the singing started she felt weak all over. She also complained of cold feelings and shivering feelings, fainting feelings, feelings that everything was going through space, and that everything was confused. She was very irritable. This patient had previously been seen at the Boston Lying-in Hospital where it was noted that she had hypertension, anasarca and attacks of cardiac asthma. At that time she was diagnosed as having toxemia of pregnancy and also coronary disease. When seen at the Massachusetts General Hospital, the diagnosis was anxiety neurosis, sarcoid disease as evidenced by x-ray findings and obesity.

Diagnosis: Anxiety neurosis.  
Sarcoid disease.  
Obesity.  
? Coronary heart disease.

*Case 15.*—A.M., a 30-year-old, married, white, native housewife transferred from Medical Service complaining of episodes of palpitation, pain in region of heart of approximately ten years' duration. On admission she was tense, and restless. There was a pulmonic-systolic murmur, knee jerks were hyperactive, fine, lateral nystagmus movements, marked red streak on stroking skin. E.K.G. negative. Question of syphilis.

Diagnosis: Anxiety neurosis.  
Malnutrition.

*Case 16.*—J.T., a 48-year-old, married, white, native born motorman complains of headaches, episodes of dizziness, nausea, weakness and nervousness of three months' duration. He has had episodes characterized by palpitation of the heart, pain around the precordium, "smothering" sensation of tremor, fear that he might lose consciousness. He has felt anxious off and on for the past six years. Physical examination shows chronic pulmonary emphysema and a systolic murmur at the apex. Liver margin is palpable at the costal margin on inspiration. There was some difficulty in pronouncing test phrases. Marked exaggeration of all deep reflexes equally. E.K.G. normal. Air encephalogram showed enlargement of the sulci and dilatation with the appearance of generalized brain atrophy.

Diagnosis: Anxiety neurosis.  
?Pre-senile deterioration  
(Alzheimer's disease).

*Case 17.*—A.M., a 45-year-old, white, foreign born, single man complained of pounding sensations, dizziness, feelings of weakness and tension of one year's duration. For the past six years he had noticed the pounding sensations. Has had many nightmares and disturbing dreams during the past six months. Physical examination negative. Laboratory examination including x-ray of chest, electroencephalogram and E.K.G. were negative.

Diagnosis: Anxiety neurosis.

*Case 18.*—A.G., a 26-year-old, white, married, native born woman admitted complaining of severe headaches, pain in the right side. She also had three episodes of peculiar behavior during the past three months with amnesia for them. The patient has also had nausea, mild depressions, temper tantrums with feelings of jitteriness. During the three episodes for which she has amnesia she showed wild, ungovernable behavior, screaming and kicking usually coming on after an emotional upset. Physical examination showed some costovertebral tenderness on the right. Marked autonomic lability with warm, moist palms and soles. Hypesthesia to brush and pin over the right side of the body and also below the left knee.

Diagnosis: Hysteria.

*Case 19.*—M.D., a 21-year-old, single, Italian female complains of pain across the abdomen, "nervousness," headaches, spells of trembling of two years' duration. She has had spells since childhood and in addition feels "nervous" all the time. The spells have been coming with increasing frequency so that she has been unable to work since the onset of the present illness. Physical examination shows profuse sweating, marked fine tremor of outstretched hands. X-ray of chest negative, E.K.G. negative. B.M.R. +6.

Diagnosis: Anxiety neurosis.

*Case 20.*—E.M., a 28-year-old, native born, white female complains of palpitation, shortness of breath, choking sensations of eight months' duration. During the past two years she has also had feelings of fear when in crowds. Physical examination was within normal limits. B.M.R. +8. Laboratory examinations including E.K.G. were within normal limits.

Diagnosis: Anxiety neurosis.

*Case 21.*—A.H., a 34-year-old, white, native born, married housewife complaining of paralysis of the left leg of one year's duration. Patient had fainting spells almost once a month following an appendectomy and suspension operation three years ago. After one of these fainting spells had been in coma for four days. Two years ago had sharp pains in the back and abdomen with vomiting. After a hysterectomy fainting spells recurred followed by complaint of pains in the left leg. She stated that she had lost sensation in left leg and that there was no feeling in her bladder to urinate. After a lumbar puncture she regained normal bowel and bladder function and felt better. At this time she noticed that she was unable to move her leg. Physical examination showed weakness of left thigh and leg, left leg is dragged after the right and left foot is not put down flat on walking, diminution of sensation over an area of left thigh which does not correspond to any conventional pattern. Laboratory examinations including E.K.G., x-rays of skull were within normal limits.

Diagnosis: Hysteria.

*Case 22.*—R.M., a 26-year-old, single, native born, male clerk complains of headache, pain across the chest, palpitation, "nervous stomach," of three weeks' duration. There is also a great deal of preoccupation with physical difficulties. He has also noticed increased fatiguability and exhaustion and at present finds it very difficult to continue with his work. He has had difficulty in sleeping, often wakes up with a feeling as though his head were three times normal size. Physical examination showed diffuse enlarged soft, non-nodular thyroid. Moderate bilateral varicocele. Successive lumbar punctures showed protein of 64 and 60 mgs. Pneumoencephalogram and electroencephalogram were negative.

Diagnosis: Anxiety neurosis.

*Case 23.*—H.W., a 46-year-old, married, white Austrian female complains of diarrhea, painful fingers and pain in the back of the left hand following a laundry accident six years ago. The patient had been seen in many hospitals without marked improvement in the condition of her hand. There was some suspicion regarding malingering in this case. Further study showed that the patient had been taking cathartics against advice in order to continue the diarrhea. She also had been picking the skin of her injured hand. Physical examination showed malnutrition. There was a Bullous dermatitis over the dorsum of the left hand and three middle fingers. The skin in this area was thickened and exceedingly dry. The left hand revealed atrophy of the interossiae and inability to make a fist or to approximate the fingers. There was beginning fixation of the distal, phalangeal joints of the index and ring fingers, complete fixation of both interphalangeal joints of the middle finger. Sensory examination varied on several occasions but showed a reduction of sensation to pin prick and touch over the whole left arm extending to the shoulder. X-ray of the left hand showed only slight decalcification of the bones.

Diagnosis: Psychoneurosis, hysteria.

? Malingering.

*Case 24.*—R.O., a 23-year-old, white, single, native born, female complains of weakness, breathlessness, headaches, palpi-

tation of the heart, feelings of nervousness for the past six years. Physical examination showed dilated pupils, hyperactive deep reflexes, exaggerated responses to skin stroke. Her gait was extremely slow, somewhat shuffling, she walked bent over, hugged the wall rather closely. Spinal fluid examination was negative. B.M.R. -1 to -13. E.K.G. showed T<sub>1</sub> and T<sub>2</sub> abnormal suggesting mild cardiac abnormality. X-ray of skull and chest negative. I.Q. 99.

Diagnosis: Hysteria.

*Case 25.*—H.V., a 27-year-old, white, married, native born student complains of feelings of being "upset," jitteriness of two years' duration. Has had attacks of palpitation, feelings of impending danger and nausea more markedly for the last six months. Has had these feelings most markedly in crowds and in the subway. Physical examination was essentially negative. E.K.G. within normal limits. B.M.R. +6 and -2.

Diagnosis: Anxiety neurosis with phobic features.

*Case 26.*—E.S., a 33-year-old, single, white, native born girl complaining of nausea, vomiting, headache and amenorrhea of two years' duration. Symptoms came on after sex experiences, last two to three months with spontaneous recovery. Has a recurrence after every sexual experience. Physical examination negative except for basal metabolic rate of -30, improved by thyroid medication. No other endocrine disturbance found after repeated careful examinations and long observation period.

Diagnosis: Hysteria.

*Case 27.*—S.Z., a 30-year-old, white, married, Italian born teacher complains of fatigue, loss of interest, panicky feelings with fear that he would go insane of about eight weeks' duration. These symptoms followed about six months of great activity in his work and followed immediately upon disappointment in his work. He complained also of a feeling of anxiety, jitteriness, sense of oppression across the chest, feeling of inward trembling. He also noticed a general lassitude, lack of ambition and fear of heart trouble. Physical examination showed left foot and left hand somewhat smaller than

right. Slight nystagmus on extreme lateral gaze, Cremasteric reflexes diminished. Right pupil slightly larger than left. Exaggerated vasomotor responses. E.K.G. and fluoroscopy negative. Plasma cholesterol was 164 mgs./100 cc.

Diagnosis: Anxiety neurosis.

*Case 28.*—R.B., a 22-year-old, single, native born, white male complaining of inability to void for the last six weeks. He also complained of headaches, backache, stomach trouble and vague abdominal pain, for the past two years. During this time he has visited many physicians without relief. He dates the onset of the urinary difficulties to a sexual experience. He felt that his belly had been swelling even though there was no objective evidence of this. Physical examination negative. B.M.R. -3 to -14.

Diagnosis: Hypochondriasis.

? Schizophrenia.

*Case 29.*—I.B., a 15-year-old girl admitted complaining of heaviness on the top of her head of two years' duration. Her family noticed that during the last two years she had shown a marked lack in interest and was not very responsive. Physical examination was essentially negative. Spinal fluid showed normal pressure, 4 white cells. I.Q. 77.

Diagnosis: Hypochondriasis.

? Schizophrenia.

*Case 30.*—M.M., a 17-year-old, single, native born female was admitted on account of feelings of being tired of six months' duration. She noted that her head felt badly, she couldn't remember, was unable to do her work. She complains of feelings of weakness and being full of gas all the time and has had difficulty in sleeping. She stated there was a boy in school who had hypnotized her. In addition, she mentioned difficulty in concentrating, complained of headaches, stated that the cords of her neck were sore. Her eyes hurt. There were no actual delusions although at times the patient expressed the idea there was something wrong with her throat, there was something pressing on her. Physical examination was negative.

Diagnosis: Hypochondriasis.

? Schizophrenia.

*Case 31.* This case is described in the text.

*Case 32.*—M.T., a 31-year-old, white, married, native born nurse complaining of diarrhea, listlessness, irritability and insomnia. There has been a great deal of fatigability recently, more marked after an operation on the right tube. At times she complains of headache and abdominal cramps. Physical examination, including E.K.G., essentially negative.

Diagnosis: Reactive depression.

Hypochondriasis.

*Case 33.*—M.F., a 15-year-old, single, white girl complaining of frontal headaches and pressure in the head of six months' duration. She also had feelings of tightness in the throat, feelings that her arms and legs were odd and did not belong to her. In addition patient had depressive feelings which had been becoming progressively worse. Physical examination revealed nothing abnormal.

Diagnosis: Hypochondriasis.

? Manic-depressive, depressed.

*Case 34.*—E.M., a 23-year-old, single, white, native born student complaining of tiredness and weakness of one and one-half years' duration. During the last year he has been home seeing many doctors, thought he had high blood pressure. During the last year he has been unable to carry on with his work. On examination one is struck with the extreme vagueness of his statements. He cannot describe his distress in definite terms. He has the feeling that there is something wrong with him and that the doctors ought to find it out. Physical examination is essentially negative. X-ray of the chest negative. E.K.G. negative.

Diagnosis: Hypochondriasis.

? Schizophrenia.

*Case 35.*—E.L., a 36-year-old, white, Russian born, married housewife came to the Out-Patient Department complaining of sterility. She had been married for the past nine years and had been unable to become pregnant. She also complained of rheumatic pains in her arms, shortness of breath and nervousness for many years. In

addition she has been depressed at times and mentions having had pressure sensations over her head. She stated that she has been unable to stop thinking of a woman friend, whom she sees every day. She believes that this friend may have hypnotized her and believes her difficulties are due to this. She also mentions having had "bad stomach trouble," pain and nausea. Physical examination showed moderate obesity, soft apical systolic murmur. Pelvic examination was negative. Neurological examination was negative. Laboratory examinations including G.I. series, x-ray of chest, E.K.G. were within normal limits.

Diagnosis: Hypochondriasis.

Reactive depression.

*Case 36.*—L.M., a 23-year-old, unmarried, white, native born girl complains of headache, restlessness and fatigue of four years' duration. The complaints began four months after an automobile accident. For the last three years the patient has had compulsive hand washing and obsessive ideas. Her behavior indicates considerable indecision. Has been observed to hold her hands in unnatural attitudes and has admitted occasional visual hallucinations. For the last three years has noticed increasing hirsutism on face, neck and chest. Physical examination negative, except for hirsutism over lower face, neck and chest. Sugar tolerance test normal.

Diagnosis: Compulsion neurosis.

? Schizophrenia.

Hirsutism (? adrenal cortical hyperplasia).

*Case 37.*—F.O., a 36-year-old, married, Italian housewife complains of pain in the shoulders, tension of one and one-half years' duration. She also complains of noises in the ears, pressure sensations over the head, jumping sensations in the joints of the upper arms. In addition to these complaints she describes having feelings of hot and cold waves over her body. She has been tired and irritated at home, upset by her husband and children. Her sleep has been poor and at times she has vague sensations of pain in her stomach. Physical examination essentially negative except for slight tenderness in left shoulder just beyond the

tip of the acromium. No limitation of motion. X-ray of chest negative. E.K.G. negative. X-ray of left shoulder shows excessive calcification in the soft tissues consistent with calcified tendon.

Diagnosis: Hypochondriasis.  
Bursitis.

*Case 38.*—R.F., a 28-year-old, single, white woman complains of being unable to feel things emotionally and feeling that nothing seems real or significant to her, loss of interest of eight years' duration. She has often had the feeling of automaton without any special desire to get better. The last six years have been spent at a farm during which time her behavior has been described as apathetic. At times she is moderately depressed. Physical examination showed right palpebral fissure slightly wider than left, right side of face moves somewhat more than left on both volitional and emotional activation. Hands and feet are cold and moist. B.M.R. varied from -13 to -24. I.Q. 136.

Diagnosis: Depression.  
Hypochondriasis.  
? Schizophrenia.

*Case 39.*—J.E., a 29-year-old, married, Latvian female complains of disturbing ideas. The ideas are that she might take a knife and stab someone, her baby, her father or her husband. She feels that she might become a wild murderess. In addition she complains of tingling, fullness and throbbing in her head. She had previously had episodes of feeling faint but since these impulses have appeared she no longer feels faint. She has also complained of feeling

moderately depressed. Physical examination was essentially negative, except for eroded and lacerated cervix. X-ray of chest was negative. E.K.G. negative.

Diagnosis: Obsessive neurosis.  
? Depression.

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## PHYSIOLOGICAL ASPECTS OF THE OBSESSIVE STATE\*

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WE ARE INDEBTED to Hughlings Jackson for the first real evidences that thought and feeling are results of neural action (16). His data were largely derived from the occasional activation, by the epileptic process, of complicated behavior patterns in patients. Such actions were obviously more complex than mere muscular fits, and quite clearly included thoughts and feelings. Implied throughout Jackson's work was the idea that thoughts and feelings, subject to elicitation by such a process as the epileptic one, must depend upon neuronal action. Concerning thought, it has been possible to gather additional evidences that this is indeed the case, not only from the field of epilepsy, but also from that of lobectomies (2, 3, 4, 5).

The "neurointellectual" system is thought of as acting in a manner comparable with that of the neuromuscular and neurosensory systems. The implication is that the nerve impulse may affect similarly the neurone beds underlying intellectual, muscular, and other functions. This in turn implies that these functions, although they differ greatly in their outward manifestations largely because of their manifold end organs, are identical from a neural

standpoint. All of these systems are thought to operate by the same laws and to be subject to the same physiological and pathological influences. It is thought possible that our greater knowledge of muscular than of intellectual function may be largely due to the fact that muscles and their actions are more concrete than ideas. Hence our comprehension of the physiology and pathology of the neurointellectual system may gain if we study it in the image of the neuromuscular and neurosensory systems. That imagery is employed in this communication, but for a new purpose. Neurointellectual and neuromuscular behavior are again compared. However, the comparison is restricted to one type of behavior, that in which repetitiveness or fixedness of action dominate the intellectual or muscular picture. These studies have led us to what we believe is a new viewpoint concerning the neurophysiological events underlying obsessive and compulsive behavior. The presentation of this point of view is the purpose of the paper.<sup>1</sup>

### REPETITIVENESS AND FIXEDNESS

Such repetitive or fixed behavior, when clinically observed in the strictly psychological (neurointellectual or neuroemotional) domain is ordinarily thought of as obsessive. In the psycho-

<sup>1</sup> For the sake of simplicity in presentation, the neuromuscular system, and not the neurosensory and others, will be mainly employed. But, whenever the neurointellectual system is compared with the neuromuscular, comparison with the others as well is implied.

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motor field it is called compulsive, and in the strictly motor sphere it has a variety of names, depending largely upon the syndrome in which it appears—perseveration, catatonia, propulsion, iteration, echolalia, pallilalia, stereotypy of movement or thought and others. Indeed, if examples leading from perseveration to obsessive thinking are presented in sequence, it is difficult to make a fundamental distinction between any two of them. The uniform thread of repetitiveness or fixedness which runs through all of these suggests that a common physiological mechanism may underly them all, regardless of the behavior field in which they are clinically manifested.

It does not seem unreasonable to adopt the hypothesis that repetitive and fixed behavior reflect repetitive and fixed neural activity—a physiological process which is, supposedly, a normal property of either neurones or neurone chains (19a). We may suppose that it can occur anywhere in the nervous system and influence behavior of any and every variety.

This presentation will be made with the emphasis upon the obsessive and compulsive states, their relationship to the other clinical phenomena just mentioned, and their dependence upon what we believe to be the underlying repetitive or fixative mechanisms. In this way, these states may be brought into better alignment with other expressions of neural activity and thus, perhaps, be better understood. In any consideration of the physiological processes underlying psychological events, it is essential to maintain a rigid separation between the terminologies of psychology and physiology. Although such a statement may appear trite and unnecessary, it deserves emphasis because of a common tendency to confuse the two vocabularies. As an illustration of the needed distinction, in discussing

obsessive and compulsive symptoms, the argument will not even touch upon the customary theory that such symptoms are a compensation for or an expression of repressed anxiety. It is the neural mechanism by which the symptom is produced in which we are interested, whether the precipitating factor is an electrical stimulus (*v.i.*) or an unconscious anxiety state.

Symptomatically, obsessive and compulsive states are characterized by repetition or fixedness of thoughts and actions. The simplest obsessive and compulsive symptoms are most distinctly of this nature. Examples of symptomatic repetition are the touching of fence posts, various counting rituals, and compulsive-somatic habits. Instances of fixedness are the unshakable maintainance of a given series of thoughts or actions until a known, often clearly defined end point is reached. Repetitiveness and fixedness are mentioned separately because in some respects a given symptom may appear to represent either one or the other. There is obviously considerable overlap, however, and it is questionable whether or not there is a real difference between them. Pick speaks of "tonic perseveration." Both he and Liepmann employ this conception as a means of relating repetitive and fixed action. Whether they are to be considered separately or not, they appear to represent a type or types different from other types of neural action.

The theory that repetitive neural processes as such occur is by no means a new one. Kubie (18), in trying to explain various types of spontaneous involuntary movements, described in detail a hypothesis of "closed circuits" in the brain. He was unable to present actual evidence that there were such circuits, but he showed with ingenuity how such circuits, if they did exist, could answer many questions. Inde-

pendently, at about the same time, Barany (1) also spoke of closed rings in the central nervous system. Ranson and Hinsey (21) devised a similar hypothesis, in an effort to explain after-discharge. They discussed their thesis in association with the remarks of Forbes (12) who was the first to postulate central reverberation as an explanation of certain experimental data.

No facts bearing upon the matter were adduced until the work of Lorente de Nó (19b) appeared. He has finally presented evidence that closed or "self-reexciting" chains actually exist anatomically, and he believes that they are "the fundamental factors in the nervous system" (19b, p. 281). He states, "The closed chain of neurones may play different rôles according to the number of links that it contains. If the number is small, activation of the chain may result in inhibition, but if the number of links is large enough it may result in sustained facilitation or discharge." Much evidence is presented to support these statements.

The actual experimental production of a state of repetitiveness has been reported by one of us (6) as follows:

"During the electrical exploration of a human cortex, an area was found which when stimulated, produced perseveration of speech. The area (area X) lay on the mesial side of the left hemisphere, in area 6, probably just above the junction of that area with the posterior part of area 32.

"The patient, under local anesthesia, said the alphabet. At each application of the stimulus, and throughout the period of stimulation, the letter the patient was saying was repeated over and over again. The perseveration ceased instantly when the stimulus was stopped.

"Area X is far from any known part of the speech zone. It influenced the function of distant neurones, and in

such a way that these neurones were thrown into function again and again. It was as though the impulse were imprisoned in a given cell group, able to activate that group only, but unable to pass to another.

"The phenomenon, as observed, is one of repetition. Clinically it seems to be identical with perseveration of speech. But its major interest lies more in its repetitiveness as such than in its identity with perseveration.

"We may discern, in the occurrence reported, a physiological way in which repetitive action in the motor, sensory, intellectual and feeling tone spheres may be elicited, and thus, especially, how repetitive thinking and feeling may be induced."

#### PRESENTATION OF DATA

The evidence presented in this paper will consist largely of descriptions of various types of motor and mental repetition and fixation, all abruptly precipitated by a definite physical stimulus. A natural order will be followed, starting with the simplest phenomena having no seeming connection with clinical obsessive or compulsive activity, but leading by apparently inseparable stages to manifestations which are clinically indistinguishable from them.

#### EPILEPTIC CASES WITH OR WITHOUT BRAIN TUMOR

##### *Case 1. Iteration in the sensory sphere produced epileptically.*

R.H. suffered from generalized seizures on the basis of a verified vascular anomaly of the left temporal lobe. Each seizure was initiated by an auditory repetition, like a hallucination, of whatever words or sounds reached her ears at the time. For example, if she heard, once, "It's cold today," this phrase would be heard repeated five or six times, whereupon the patient would

lose consciousness and go into a convulsion.

*Case 2. Fixation in the motor sphere, produced epileptically.*

Fixation of gaze in the course of the aura of convulsive disorders is not unusual. E.A.Q., a white male of 42, who later underwent a unilateral lobectomy for a right frontal astrocytoma, was subject to convulsive attacks. On two occasions, they were noted to occur in conjunction with forced fixation of gaze. Once, while sitting in his car, he found himself unable to avert his gaze from a traffic light. Despite efforts to the contrary, he continued to stare in this fashion for about 30 seconds, and then lost consciousness. In the other instance, his gaze became fixed upon the eyes of a young woman, whereupon he found himself suddenly unable to move his limbs and to continue walking; while standing, looking fixedly into her eyes, he lost consciousness and had a convulsion.

These states can be compared with those of another patient, in whom convulsive seizures began with a fixation not of gaze, but of thought.

*Case 3. Fixation of thought, produced epileptically.*

C.F., a white girl of 16, presented a verified right temporal lobe spongioblastoma. She had convulsive seizures, which commenced with "the coming into my mind of a certain thought which sticks there until I go out." In C.F., pure thought, without motor expression of any kind, was the prelude to the neuro-muscular seizure. Jackson has alluded to several instances of this sort, although in his cases the site of the lesion was not discovered (16).

A similar condition is to be found in one of Chlopicki's oculogyric crisis cases. A 25-year-old man could not shift his attention from one subject to another during attacks. A heard conversation had to be thought about

indefinitely, and it was impossible to divert the stream of thought (8).

*Case 4. Similar to Case 3, but the patient had the feeling of compulsion to think the forced thought.*

In this patient, P., who had a verified right temporal lobe tumor, the convulsive seizures were initiated by the persistent impulse to think of the beginning of a certain story. The neuro-intellectual unit in this instance was more complex than that of the single thought of C.F., composed as it was of a sequential series of thoughts which constituted the first part of a story. It is true that both C.F. and P. had partial amnesia for the particular thoughts in question, so that they could never report them verbatim.

The relations between these relatively simple states of forced thinking on the one hand, and obsessive ideas as we usually see them on the other, is, of course, of primary interest, and P's attitude toward his forced thoughts is notable in that connection. To him the situation was of obsessive nature; he felt that "I am forced to think of the story." The thinking of the story did not appear to him to be impersonal and detached as it was with C.F.; on the contrary, it seemed that he was being compelled to think of the story. A patient of Ewald's (10), with post-encephalitic paralysis agitans described a similar state. During the course of the disease the patient developed the symptom of suddenly turning his head to the left and looking in that direction. The head and eyes would remain thus fixed until the patient went to sleep, even if many hours elapsed. The attack would start with the movement of the head and eyes, and just after they had moved, the idea would come to the patient that he had had to perform the movement. The occurrence of this idea would seem to give the situation an

obsessive appearance symptomatically, but this may not be really true, since the idea was secondarily superimposed upon the movement in Ewald's cases and upon the thought of the story in P.

*Case 5. Fixation of gaze and thought epileptically produced on some occasions and psychologically on others.*

A closer analogy between such occurrences as described and clinical compulsive states is to be seen in the case of L., 32 years old, a white male epileptic without brain tumor, seen at Neurological Institute.<sup>2</sup> He had both minor and major seizures. The onset of the major ones had features in common with the cases already described.<sup>3</sup>

L. would suddenly find it impossible to avert his gaze from whatever he was looking at. The same process involved his attention; he could not divert his thought from whatever it happened to be on. An example occurred while L. was at the Neurological Institute. He was playing bridge with some other patients. Suddenly, while he was looking at his cards, he became aware that it was impossible for him to look elsewhere; also, it was impossible for him to think of anything but his cards. In a few seconds, he had a convulsion. L. illustrates how an epileptically produced process of fixedness can affect both the muscular and intellectual systems.

The case differs from the others in that L. had similar experiences fairly frequently without a seizure, or at least, without any indications of one, although it cannot be proved that subclinical seizures did not occur at such times. But L. showed still another symptom which occurred invariably without association with attacks, and which came in such a way that their

independence from the convulsive, and their similarity to the compulsive state as it is ordinarily viewed, can hardly be doubted. This symptom appeared almost every time L. read any text or added a column of figures. In reading, his attention would become fixed on the first word, and sometimes on the first letter of the first word of each line. In adding, the same fixation occurred with each figure in the column. He could not force himself to progress to the next letter, word or figure without severe discomfort, nor could he give adequate attention to the succeeding symbol until a certain interval of time had passed. Then he would be able to proceed in reading only until he came to the next line, and in adding, only until he reached the next figure.

These reading and adding symptoms can scarcely be considered as anything but compulsive in the orthodox sense. But it would be difficult to distinguish between the intellectual fixedness they showed and that manifested both intellectually and muscularly just prior to the seizures.

#### SIMPLE PARKINSONIAN CASES FROM THE LITERATURE

The hitherto reported observations which touch the subject most closely are certain ones on post-encephalitic Parkinsonian patients. In such patients, the similarity between muscular and intellectual states of repetitiveness or fixedness is often so striking as to be inescapable. It would be futile to review the entire cognate literature on post-encephalitic repetitiveness or fixedness. Excellent descriptions have been given by Steiner (23), Ewald (10), Mayer-Gross and Steiner (20), and Bürger (7). These observers were struck by the likeness between the effects of the post-encephalitic process on thinking and muscle action. Hohman made a similar suggestion in 1924, speaking

<sup>2</sup> All of the cases at the Neurological Institute were on the service of Dr. Henry A. Riley.

<sup>3</sup> L's electroencephalogram was not definitely abnormal, but from clinical observation there was no doubt of the diagnosis.

of "mental and emotional" rigidity (15).

The musculo-intellectual parallelism is simply illustrated by a Parkinsonian patient of Erb's who repeated the same sentence at times for periods of minutes: "I want to go to the hospital" (9).

Steiner's Parkinsonian patient repeated the Lord's Prayer over and over. Usually, she could stop temporarily on command. It could also be terminated by having her extrude her tongue on command, but it would continue when the tongue returned to the mouth. For a period of weeks the prayer went on almost without interruption. She said, "It presses on my breast, and that drives me to pray." Another patient whistled continuously, unable to stop himself (23).

Hermann cites a Parkinsonian patient who was forced to think "you are a blockhead" every time he saw the doctor, and although he said that this did not represent his true opinion, he could not circumvent the thought, and would request the doctor to give him another thought in substitution. Another patient of Hermann's, like one of Bürger's had to repeat every phrase he heard. For a long time the thought "you are a fool, you are becoming a fool," recurred over and over for periods of an hour or two at a time. He was unable to have another thought while this one was in his mind (14).

Goldflam and others draw attention to the frequent impulse to think and speak obscenities. Goldflam's patients had a tendency to repeat over and over a word, a phrase, or an absurd request (13).

Apparently identical with these forced or obsessive thoughts and verbal repetitions are the frequent, much better known, forced nonverbal motor disturbances. Goldflam mentions "pseudo-spontaneous" movements in several of

his post-encephalitic patients—rubbing of the eyes, scratching, clapping of the hands. Steiner remarks upon the frequency of such stereotyped movements as rhythmic puffing of the cheeks, playing of the tongue against the cheeks, rubbing of the nose, tapping with the fingers, pushing of the eyelids shut with the hands, rhythmic projection of the tongue, etc.

Mayer-Gross and Steiner have thoroughly described a Parkinsonian patient who was subject to a variety of forced thoughts and acts. The report is too long for inclusion here, but the reader is referred to it as an especially interesting and careful one (20).

#### CASES WITH OCULOGYRIC CRISES

Better known, perhaps, than the ordinary Parkinsonian cases just alluded to are those with oculogyric crises, in which fixedness of mental processes occurs on association with the ocular fixation. However, units of intellect are not the only psychological ones which may be activated during attacks. In both epileptic and oculogyric seizures, the feeling of anxiety may likewise be precipitated, and in the oculogyric group this is very common, if not uniformly, the case. The fact that such patients have their symptoms in sudden attacks adds to the clarity of the linkage between the mental and muscular phases. Frequently, also, the termination of the mental and ocular disturbances coincides, often precisely. Of additional interest is the fact that the ocular phase is often briefly anteceded by either the intellectual phase or an anxiety phase or both, and that these may cease or the intellectual part may change its form abruptly, when the ocular part begins. This is reminiscent of what occurs in ophthalmic migraine, in which the usual sequence is a brief period of visual disturbance which

disappears to give place to the headache. One feature, the meaning of which is not clear, is the occasional absence of the anxiety or intellectual phase when the eyes turn downward in the crisis, although the same patients regularly experience the psychological disturbances in attacks in which the eyes turn upward (Chlopicki and others 8).

In an instance reported by Stern, fixation of simple units of thought anteceded the neuromuscular fixation (as represented not only by the ocular spasm but also by an increase in the patient's general rigidity). The patient said that just before her ocular symptoms appeared, her thoughts "stood still," concentrated on a single item, such as why the O is round, or how glass making or the written alphabet were invented. It was beyond her power to dislodge the thoughts. In accompaniment there was a "terrible feeling" (25).

Another example was a 19-year-old male patient of Stern's. Anxiety was felt throughout the attacks, and the patient had to think of words with certain meanings, such as *woher*, *warum*, *wozu*, *was*. He found that he could eject them by the use of the phrase, "Get away, Satan, Jesus is mine" (trans.). But sometimes the phrase could not be found, and he would be engaged with the words for hours.

In one of Störing's patients, the feeling of anxiety which immediately preceded the attacks promptly vanished when the attack began. In its place, however, he was forced to think about a novel he had been reading during that period (26).

More complex intellectual processes were excited in Jelliffe's case of a young man, previously psychoanalyzed for post-encephalitic respiratory disorders, who developed oculogyric crises after a new febrile attack follow-

ing an amatory adventure. Jelliffe described an attack he witnessed as follows: "His alarm (about discussion of medical procedures) was manifest and he went into one of those characteristic emotional trance-like states, with at first central ocular fixation and then upward movements of the eyes. During the attack the Parkinsonism increased, he perspired and began to murmur, 'A million ideas are going through my head; rape my sister; rape my mother; kill my brother; kill my father. Am I going crazy? Doctor, oh doctor (almost pleadingly) tell me, am I going crazy?' The anxiety, with upward and outward eye movements persisted for about 36 hours" (17).

Phenomena more closely resembling ordinary obsessions and compulsions were shown by the patients of Chlopicki (8). The first manifested some evidences of an obsessive-compulsive makeup prior to the onset of his encephalitis, and, between his oculogyric crises, displayed minimally some of the compulsive symptoms which formed part of the crisis. He suffered from nocturnal enuresis until his 15th year, and from night terrors until 23. He was punctual and exact to an extreme. Though quite sensitive to criticism, and afflicted with a violent temper, he is stated to have been well adjusted socially.

He had encephalitis when he was nineteen. Nine years later moderate Parkinsonianism was demonstrated on examination and oculogyric crises appeared. Ten to twenty minutes before his attacks he became restless and excited and complained of feeling hot. He worried about disturbing ideas, whether his employer or employer's wife were insulted by certain things he might have said, whether he really had closed the window, whether the door of the room was properly closed. He would wash his hands repeatedly during these

episodes, look under the bed to see if anyone were hiding there, and dust his chair carefully before seating himself. Resistance to any of these compulsions gave rise to restlessness and anxiety. He was so tormented by these thoughts that he threatened to end his life. The manifestations continued through the attacks.

In Chlopicki's second patient, anxiety and certain persisting phrases were associated with the crises. A half hour before the attack she would complain of headache, restlessness and a fear of insanity. Thereupon there appeared the thought, "whom the Gods destroy, they first make mad," which expression persisted in her consciousness despite all efforts to throw it out. With the onset of the attack proper, other similar manifestations appeared. For example, she found herself compelled to repeat inwardly words and phrases overheard in her environment, or was plagued by the reiteration of a melody, verse or expression. When she tried to interrupt this constant repetition by praying, the first words of the prayer repeated themselves endlessly. There was occasional pallilalia. These symptoms vanished with the end of the oculo-lyric crisis.

*Case 6. Oculo-lyric crises with manifestations suggesting an obsessive-compulsive state.*

This patient, seen at the Neurological Institute, displayed most of the features discussed—the units of the psychological and somatic manifestations, the incidence of what appears clinically like an obsessive-compulsive state, and an anxiety factor. Two features of particular interest are the paroxysmal character and the complexity of the psychic picture. The patient, a white woman aged 33, contracted acute encephalitis at the age of 10, exhibiting almost immediately thereafter diplopia, hypersalivation,

and motor retardation. At the age of 21 oculo-lyric crises appeared, and these have persisted with increasing frequency and severity.

Although she was otherwise free of unusual anxiety or fear and of obsessive-compulsive behavior, these symptoms completely dominated the picture during the course of the oculo-lyric spasms. Attacks were preceded by nervousness, and a vague sense of impending doom. The eyes suddenly rotated upward, the patient's head extending so far backward that she was threatened with losing her balance. The patient was then suddenly assailed with fear that she was unable to pass urine or feces, though there was no subjective sensation of fullness of the bladder or rectum. She maintained complete insight into the absurdity of the idea, but was powerless to control it. Under the influence of this overwhelming anxiety concerning her eliminative functions, and despite obvious difficulty in getting about in her extremely awkward position, she would find her way to the lavatory and attempt evacuation, most often with no success. Beset by the compulsion on the one hand and inability to fulfill its stipulations on the other, she would burst into tears. These difficulties occupied her full attention. She tried vainly to rid herself of her delusive ideas by attempting to divert her thoughts elsewhere. Again and again she was compelled to attempt evacuation. The entire structure of this mental and emotional complex would vanish with the disappearance of the oculo-lyric crisis.

The factors responsible for the origin of this particular manifestation in its psychological sense could not be determined by routine psychiatric methods. Nevertheless, this is not our immediate concern; rather to be stressed

is the fact that here is represented a unit symptom complex with "psychological" coloring, which appears regularly in conjunction with the somatic paroxysms of a physical disorder. Its dominating feature is the element which has all the clinical appearances of an ordinary obsessive-compulsive state. From a psychological standpoint, this element could be described as a miniature obsession-compulsion neurosis. Acting as a unit, it can be ignited in close neurophysiopathological relationship with the oculogyric crisis of Parkinsonism. Hence it would appear that this psychic manifestation has an independent structure of its own, which, as a consequence, is subject to innervation and activation like any other neural structure.

This concept is further supported by an additional symptom also shown by the epileptic patient L. (case 5, *v.s.*), in which an old, forgotten compulsion was reactivated as a complete unit by the epileptic process. The symptom affords another link between the physiological situations that have been discussed, and obsessions and compulsions in the clinical psychiatric sense.

This symptom, a compulsion, was well illustrated following an observed convulsive seizure. The patient, seen in bed immediately upon the termination of the convulsion, opened his eyes and stared about dazedly. He appeared drowsy, and to have difficulty in keeping his eyes open. Within a few moments after recovering consciousness, he began to swallow repeatedly, making smacking noises with his tongue, and accompanying each swallow by a grunting noise produced by the forcing of air through the nasopharynx. This process was repeated every few seconds for about five minutes, while the patient exhibited little other activity. When finally he was asked the reason for this action, he stated, in a

strained voice, "I can't help myself,—I just have to swallow." When pressed for an explanation he stated that he experienced an overwhelming desire to swallow in just this fashion, and that in the face of his desire he was powerless to resist. He revealed that 19 years before, when he was 13 years old, he had been given to the habit of compulsive swallowing, which plagued him for over a year, and which proved a problem to himself and to his family. He recalled that failure to swallow had given rise to intense discomfort, amounting at times to anguish. The symptom had gradually disappeared as he grew older. After about five minutes of this conversation, during which he was closely interrogated, L. finally begged that the matter be dropped, since he preferred to put his mind upon something else. The request was complied with, and when later seen, the patient was sleeping soundly.

When L. was again seen a few hours later, upon being reinterrogated concerning the swallowing, he denied any recollection of the previous conversation. However, when reminded of what had transpired during his post-convulsive state, he gradually recalled the events as they had occurred. He was somewhat bewildered at the partial amnesia, but was particularly interested in the swallowing episode. He stated that it was the first time in years that he had thought of his former habit, that it had completely slipped from his memory. He now found that the recollection brought with it a profusion of similarly lost memory-records and vivid feeling tones all concerned with that immediate age period; he could not describe these clearly, however, and they served only to establish a vague background from which stood out, in sharp relief, the actual compulsive symptom. In discussing the swallowing activity that followed his seizure, he

once again emphasized the overwhelming compulsion to swallow to which he had been forced to accede, marvelling at its intensity.

In this case, an ancient compulsive action system of very simple proportions was momentarily revived by an epileptic seizure, and then, as quickly, was obliterated. This seems to show that the compulsive habit represented the action of a specific group of neurones, which had retained its identity as an isolated unit in the brain over all the years. When suddenly reactivated by a pathological process, it behaved precisely as it had done years before. The essential point is that it existed, as an integral, discrete unit, although evidently unused and inert, and remaining out of consciousness. Its prompt lapse back into unconsciousness after the seizure is equally striking. Such an instance indicates the possible existence of a demonstrable neural structure for unconscious activations. This can be suggested despite the fact that, in this particular case, there is no evidence that unconscious activity did occur. The momentary revivification of memory patterns and old feeling tones shows, too, that there were additional linkages to the neurone bed of the swallowing pattern, and that they constituted one large neurone group, which was reactivated and again obliterated as a unit.

In a patient of Stengel's, the oculogyric crisis evidently was accompanied by a similar revivification of forgotten patterns more complex than L's. (24) In addition, Stengel's patient responded to this reactivation with obsessive action. She was a girl of eighteen who, at the age of nine, had had encephalitis. Soon, she exhibited sleep disturbance and tremor, and oculogyric crises had occurred from the start. At first her thoughts during the attacks were not unusual, but later she was

compelled to say aloud, "*weil ich nur, weil ich nur,*" etc. The full thought, which only occasionally was carried through to its conclusion was, "I do not need to be afraid, because I have good parents who always give me something to end the attack" (trans.). She also had anxiety lest she hit someone or pull his hair, or that her grandmother would die.

As time passed, the attacks grew much more severe, and became associated with a compulsion to run. The direction she pursued depended upon the position taken by the eyes; she ran straight ahead when the eyes turned upward and in circles when they turned to the right.

She had a great fear of falling while running, and was obsessed by the idea that a white ghost, a man whom she could not describe, was running after her, trying to overpower her. She feared that the pursuit would terminate by her falling into a cesspool.

These fears corresponded to actual traumatic episodes. She had fallen into a cesspool at the age of three, and had been overpowered by a strange man at thirteen. In the sleep that followed the attacks she often dreamed of erotic scenes with a childhood friend, but never of the traumatic experiences revived during the attack. But two or three times a week she did dream of the attack itself.

This case is interesting for our purpose since the origin of the content of the obsessive thought appears to be traceable. An old thought chain which no longer existed as an independent entity in the girl's normal conscious life apparently was reactivated by the same process which affected the ocular muscles.

*Case 7. Epileptic activation of habitual compulsive phenomena. No oculogyric crises.*

Here again, ordinary compulsive

phenomena which in this instance had been shown repeatedly for years by the patient, were susceptible of activation, this time by the epileptic process (not encephalitic and without oculogyric crises). The patient, M.Y., a white boy of 13, seen at the Neurological Institute, was of decidedly compulsive personality, having a large and complex variety of actually compulsive habits. Evidences of compulsive behavior were manifested in many ways. For example, the patient felt constrained from time to time to stretch his penis, which seemed uncomfortably compressed by folds of suprapubic fat; he would repeatedly stretch, with his fingers, the skin of one side of his face for relief of a sensation of stiffness there; every night before going to sleep he conscientiously stretched open the lid of the right eye, imagining that it was lower than the left. Failure to perform these ritualistic maneuvers gave rise invariably to discomfort. Many phobias were manifest, such as fear of the dark, of going any distance from home, of being alone, of riding in trains, of being followed. He also showed such mannerisms as nail-biting and facial grimacing.

The boy also had the habit, long in duration, of loudly proclaiming that he had to go to the toilet, whereupon he would rush there, usually passing only a small amount of flatus, feces or urine. He would declare that he obtained a feeling of great relief from these procedures, actually out of all proportion to the apparent pelvic need. This act was repeated for years, many times a day,—sometimes as often as two or three times within five minutes. (It is of interest that this behavior may have been conditioned early in life. When Y. was very young, he suffered considerably from various forms of gastric upset, particularly eructation, borborygmus, distension and flatulence,

and as a consequence was forced to choose his diet carefully. No physical cause for these disturbances had been discovered.)

In addition, Y. had had a convulsive disorder since infancy. Electroencephalograms substantiated the diagnosis of epilepsy. According to the mother, gastrointestinal symptoms were an invariable precursor to his attacks in early childhood.

In later years, the character of the seizures changed, in that some of the phobias and compulsions became incorporated into the seizures. As with the forced swallowing in the case of L, this incorporation was of such a form that it could only be said that the neurone bed underlying the habit was ignited or released by the epileptic process. Many of the patient's seizures came to be ushered in by characteristic mental symptoms, phobias for the most part, similar in content to those from which he had been suffering for many years. Among those which came to initiate the convulsive seizures, fear of being alone and of being followed were outstanding. Immediately upon regaining consciousness following a seizure, the patient consistently complained of a powerful impulse to pass gas, feces, or urine and would run precipitously to the bathroom to relieve himself, and, as with his long-standing habit, although he produced only insignificant evidence of any real bodily need, he would still claim complete, though temporary, satisfaction.

This case, like the preceding ones, demonstrates how a psychological symptom such as a phobia or a compulsion can manifest itself as a complete unit, and how these units in becoming incorporated with the epileptic seizure, exhibit characteristics consonant with the known laws of neural structure and function.

## DISCUSSION

The recognition of repetitive or fixed ways of neural behavior is not novel, as has been explained above. As will be seen too, others have recognized a parallel between thinking and muscle movement insofar as they are effected in the post-encephalitic state both with and without crises. Our own purpose has differed from that of other authors, in that we have focussed upon the obsessive states, indicating what we consider their clinical relationship to other repetitive and fixed states, and the basic dependence of all of them upon fixed or repetitive neural action. The phenomena of disease have been collected and employed only for the elucidation of those relationships.

Our theory is that the external manifestations of obsessive or compulsive behavior are the reflections of a certain specific kind of neural activity. They occur when a given neurone organization acts in either a fixed or repetitive manner; when those neurones, instead of being activated once by an impulse which then passes on to other neurones, imprisons the impulse so that it either keeps the neurones in a constant state of activity, or it reactivates the same neurones again and again. The theory has appeared useful to us because it permits the alignment with comprehensible physiological occurrences of a state of behavior which is ordinarily difficult to classify. Psychological matters should be better understood when they can be thought of as obeying the same laws and as following the same patterns as events in the so-called somatic sphere. In studying the various and widespread somatic reflections of repetitive neural action, a natural order is found, starting with the simplest motor phenomena having no obvious connection with obsessive or compulsive acts, but leading by evidently inseparable stages to manifestations which,

by appearance, are indistinguishable from obsessive or compulsive acts.

Such repetitive or fixed action exists as a normal phenomenon,—one, in fact, without which normal, economical use of the body including the brain, would be impossible. There are many familiar examples of normal repetitive or fixed action which reveal themselves in both the “somatic” and “psychological” spheres. Common and relatively simple examples of fixed somatic behavior are states of maintained muscle tone such as occur in standing at attention and in lifting. Prolonged states of this kind are usual in some animal forms, and are especially well seen in many amphibians and reptiles such as turtles, alligators, chameleons and snakes. Repetitive somatic action occurs, for example, in the tail waving of resting fish, in respiration and in the heart beat.

More complex normal states of repetitive neural action are seen in the orgasm and in human laughing and sobbing. These acts, and also others like sneezing and coughing, reveal repetitive action not only in isolated form, but in association with another element which resembles an important psychological phase of obsessive and compulsive states. As with sneezing, coughing, etc., when an obsessive thought or a compulsive act is held back from expression, an increasing feeling of discomfort develops, with acute awareness of the conflict between the “urge” to give expression and the desire to prevent it. Sneezing, coughing, etc., are, however, relatively well understood examples of ordinary neural stimulation, and we can visualize the inability to prevent the completion of the reflex in comprehensible physiological terms.

In the “psychological” sphere, repetitive action is seen under such conditions as concentration of thought

or the giving of attention, in memorizing and in innumerable everyday habits which, symptomatically, do represent usually "unimportant" obsessions. Normally to a slight, and pathologically to a high degree, may be seen another type of symptom whose nature appears to be the direct opposite and which may possibly depend upon a reduction instead of an increase in neural repetitive action—distractability and flight of ideas.

The evidence from the postencephalitic states which we have employed as a part of the ground work for the conception in which we are interested, has received widely different interpretations from very able investigators. Schilder (22) and Jelliffe (17) have led in the primarily psychological interpretation of these phenomena. The reader is referred to their studies for a full exposition of their views. Jelliffe's monograph is extremely comprehensive and we have leaned upon it heavily as a source book.

Our view differs fundamentally from theirs. Jelliffe, not altogether tacitly, distinguished between psychological and physiological functions. Had he not made this separation, it might be that the two viewpoints would approach each other closely. Jelliffe infers a psychological basis for the crises, whereas we see both the somatic and psychological phenomena of the crisis as the common result of the sudden preponderance of fixing and repeating processes over all others, throughout the brain. To us, the content of the obsessive thoughts is secondary, the point being that whatever is thought will be obsessively thought. We do not deny the possible "psychological" conditioning of some attacks and we agree that almost anything that happens to patients may have its content so conditioned. But that is quite another thing than a psychological origin of the

attacks themselves. Why may not "the psyche" be considered incorporated in the somatic processes, instead of the opposite, which is Jelliffe's implication?

Bürger's opinion, (7) based upon non-crisis Parkinsonian cases is related to ours, although he does not develop it as far as we attempt to. He writes, "The essential point to be stressed in these cases, of which there are too many to report in full, is that there are represented a full series, from simple automatism, from compulsive and instinctive, through affect-full and affect-conditioned behavior, to classical compulsive thinking . . . . If for the moment we do not trouble ourselves with the personality, and the position the patient takes toward this total behavior picture, we see these performances to a certain extent not from the psychogenic point of view at all." (trans.)

Steiner also saw a parallel between the fixity of thinking and of movement in the post-encephalitic crisis states and considered thought and movement to be influenced by the same process (14). Erb (9) and a number of other authors appear to have held like views, although Steiner's statement has seemed the clearest to us.

In all of the instances here presented, the stimulus which set off the reaction was, we think, a physical process. What is the relationship between these and comparable states ignited without such a physical stimulus,—to obsessive states in the orthodox sense? That identical states can occur in response to "psychological" stimuli, is indeed, a major implication of our thesis. But "psychological" merely refers to processes in the domain of thinking, and broadly speaking, of feeling. And "psychological" processes and stimuli are just as real and physical as epileptic, post-encephalitic or electrical stimuli. Neurones of thought, it is

supposed, can themselves serve as the stimulus for repetitive and fixed responses, under both normal and pathological conditions, just as can an electric current or the epileptic or post-encephalitic processes. The strictly neural mechanism of such occurrences is shown under post-encephalitic conditions by a patient of Störing's with oculogyric crises. Attacks were prone to be precipitated by concentration on intellectual work. And the moment the attack started "his thoughts stood still" (26). This illustrates an effect upon the physiology of thought, produced by thought itself. In some other cases, such as that of Flach and Palisa, crises could be induced by hypnosis (11).

In ordinary obsessions and compulsions, neurones of intellect or of feeling are similarly thought to be among the igniting agents. Those states may be excited by such neurones, it is believed, just as the electrical shock produced speech repetition in the surgical case mentioned above.

#### SUMMARY

It is thought that a "neurointellectual" system exists and that its behavior is influenced by the same physiological and pathological processes as the neuromuscular, neurosensory and other systems.

One of these processes, that of repetitive or fixed neural action, has been studied in its relation to both neurointellectual and neuromuscular function. Many different clinical symptoms of various types are the result of such neural action. In the "psychological" sphere, these symptoms appear as obsessions and compulsions. The neural basis of obsessive and compulsive states is illustrated and discussed.

It is believed that such a concept does not conflict with the theories of

the "psychological" origin of such symptoms under other circumstances, but rather that it adds to our understanding of the physiological structure and function of the thoughts and feelings which ignite these "psychological" disturbances. In demonstrating how an intricate symptom such as an obsession may be viewed as a function of a neural unit, form and body is given to an entity which has existed clinically as a reality, but physiologically only as an abstraction.

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## A NEUROPSYCHIATRIC STUDY OF TRAFFIC OFFENDERS\*

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THE TRAFFIC problem is one of the most serious confronting the living organism. Deaths on the highway and on the city streets are increasing rapidly. The use of the automobile, a result of the highly developed human nervous system, also taxes that nervous system to its utmost because many of the activities of the individual bring him unexpectedly or uncontrollably into relationship with that moving, potentially homicidal object, the automobile. It is necessary for the individual to have perfect coordination in avoiding an automobile which is rapidly approaching him and to have perfect coordination in handling one. His psychosensory equipment must be adequate, so that he can sense and perceive traffic complications. The improvement of roadways and of the machine itself are problems for the engineer, while the examination, study and treatment of the operator definitely fall upon the shoulders of the physician. Since these problems are chiefly those of the neural mechanisms permitting an awareness of external conditions and the coordination of motility, to comprehend them the neurologist and psychiatrist must bear the brunt of the problem.

The present study is an analysis of one hundred cases of traffic offenders referred from the Traffic Division of the Recorder's Court of the City of Detroit to the Psychopathic Clinic of that Court. The study is controlled by a similar examination of one hundred licensed applicants and by a short

study of fifty chronic neurological cases in Eloise Hospital (a county institution). It is an analysis of the first hundred of a study of one thousand cases and the practical point of this original study of one hundred cases was to see whether it would be worth while to set up a special unit in the Psychopathic Clinic to examine traffic cases, and, if so, what was to be expected in the way of neurological and psychiatric disease which might or might not interfere with the traffic offender's ability to operate an automobile.

The methods used in examining these cases were conventional but thorough. A complete history was taken, covering the circumstances of birth, the health history, symptomatic history, and social history (including the economic and educational). The individual was given a psychiatric and physical examination, including a thorough neurological. The results have been tabulated and studied with reference to a few salient factors. The one hundred cases examined were selected by the Judges. The criteria used were subjective on the part of the Judges, no particular advice being given them except that any cases appearing before them which seemed to be peculiar, queer, or crippled be sent to the Clinic for examination. Since there were two Judges, there might be two different opinions on any border line case, although it is to be presumed that any frank case would have been referred by either.

It is interesting in this connection to

\* From the Psychopathic Clinic of the Recorder's Court, Detroit, Mich. Series T, No. 3.

note the statements made by the Judges in referring cases. Of course in many instances the pathology was so self-evident that the Judge did not feel a need for stating why he referred it. In other cases the impression was so subjective that he could not give a specific reason. Some of the statements following the place on the blank entitled "Reason for Referral" are as follows:

1) "See what is causing nervous condition and see if capable of driving an automobile."

2) "Lazy body, question of alcoholism, doesn't seem very intelligent."

3) "Question as to mentality and physical ability."

4) "Examination for his nervousness." (This was a case of manic-depressive psychosis.)

5) "To find out if he is qualified to operate an automobile on account of his eyes." (In this case no visual defect was found.)

6) "For medical examination as to mentality." (This was a case of epilepsy.)

7) "As to mentality." (This was a case of schizophrenia. The Judge apparently thought that he was feeble-minded.)

8) "The defendant denies habitual drinking." (This was a case of chronic alcoholism.)

9) "Evidence of epilepsy."

10) "Defendant claims loss of memory while driving at eighty-five miles per hour." (This man was malingering and during examination admitted that he remembered every thing about the case.)

11) "To find out if he is mentally capable, why does he get so many traffic tickets." (This man had twelve offenses in two years and was a markedly psychopathic personality.)

12) "This woman has a defective child and seems of low intelligence."

(She turned out to be a mentally defective person herself.)

13) "This defendant is a very heavy drinker and has been in Court several times."

14) "Responsibility as to ability to drive an auto at the time of an accident." (In this case the man admitted drinking at the time, he also was a psychopathic personality and had a visual defect.)

15) "Is he fit to drive—epilepsy?" (The man was an obvious epileptic as was case No. 9. The reason these two cases are of particular interest is because in Michigan there is a question to be answered about epilepsy on the application for driver's license. In one of these cases the man had no driver's license; in the other he had lied about not having epilepsy when he applied and presented a very complete history when thoroughly studied later. While he denied his condition at first, he admitted it later when he was shown that he had scars from biting his tongue and also one on his forehead where he had struck it in falling.)

In this connection it is interesting to note the amount of insight the Judges had in these cases. However, in many others in the present study, the Judge merely sent the case because of some hunch, indicating probably that a vast number were overlooked who might be picked up in a systematic and comprehensive study. The present sampling of one hundred cases represents less than a quarter of one per cent of all the cases going through the Traffic Court. In all probability the present group is representative of the most serious cases and one hundred cases taken at random from all offenders would not produce as many defects as this study will show below.

#### HISTORICAL

The literature of psychology is filled

with references to work done on traffic offenders, accident prone drivers, and professional automobile operators. Several European observers, most prominent among whom is Lahy (3), have devised tests for automobile operators, bus drivers, and locomotive engineers, with the result that accidents in Paris, for example, have been reduced considerably among the groups who have been selected by means of these tests. In the British Isles, at the Institute for Industrial Psychology, Myers (4) has devised tests which that Institute recommended for adoption, through the whole of the British Isles before any individual should be licensed to drive a motor car. In the United States as far back as 1928 Lauer and Weiss (6) devised a battery of tests which would test reaction time, judgment of speed and distance, and perception of various sorts which would be required in driving an automobile. In the same year Raphael *et al* (5) made a study of traffic offenders. In 1930 DeSilva (2) of Harvard modified Lauer's tests and has recently standardized these tests on some hundreds of thousands of drivers with the result that he has come to some general conclusions that have not indicated the advisability of using these tests either for the individual driver to obtain a license or for the traffic offender in order to make him less accident prone or violation prone. All of these observers except (5), being psychologists without medical background, have ignored the relation of nervous and mental disease to the traffic problem, and they could be in no position to evaluate whether or not an individual suffering from an organic disease of the central nervous system should drive a car. It is quite probable on the surface that if sufferers from an organic disease of the nervous system are physically able to drive a car and do so they are more likely to get into

trouble than those who merely have a deviation because of a slight congenital inadequacy of the coordinative mechanism which the psychologist's test would be more likely to locate as Canty (1) indicated. It must be admitted, however, that the addition of such tests in the hands of a competent neurologist or psychiatrist might be of value in detecting latent nervous disease, the existence of which is somewhat suggested by the information which will follow later in this paper.

It must be obvious that the frankly insane should not be allowed to drive and probably the frankly feebleminded must be eliminated, although some of the studies of Lauer would indicate that there is only a questionable correlation of actual driving ability with intelligence. It would seem inadequate to study the psychophysics of driving without having a complete understanding of the neuroanatomy and neuropathology involved in it.

#### DATA

Table I shows the distribution of all cases through the Traffic Division of the Recorder's Court during the year 1935. While the present cases were mostly seen in 1936, the numbers give an idea of the size of the sampling and also suggest how obvious the symptoms were to the Judges in order that they were selected out of the vast number involved.

TABLE I  
CASES IN TRAFFIC COURT DURING THE YEAR 1935

Manslaughter, Negligent homicide,		
Leaving Scene of Accident.....	total	103
Reckless Driving and Drunk Driving	total	1,353
Minor Violations.....	total	263,862

Out of the vast amount of material obtained by studying the present series of cases certain of the most important factors were isolated and analyzed. When one considers that the history taking and examination of each one of

these cases often required eight or nine hours, it is obvious that for the purposes of the present study all of the factors cannot be analyzed. The first factor which was studied was *age*.

TABLE II

	RD	M	D	S	H	HR	
Up to 20	8	2	—	1	—	1	12
20-29	19	6	1	1	5	4	36
30-39	9	1	6	1	4	—	21
40-49	17	1	4	4	—	1	27
50-59	3	—	1	—	—	—	4
60 plus	—	1	—	—	—	—	1
	56	11	12	7	9	6	101

Table II shows the distribution of various cases, according to age. There are 56 cases of Reckless Driving studied, 11 of minor offenses, 12 of Drunk Driving, 7 of Speeding, 9 of Homicide and Manslaughter occurring in traffic, and 6 Hit and Run drivers. The question might be raised why there were no more speeders, and the answer is that the majority of reckless driving cases during the period when this study was made were probably speeding cases, but because of a legal complication, making it impossible to prosecute speeders under the State law, it was better to list them as Reckless Driving. Speeding was a violation of a City Ordinance and Reckless Driving a violation of the State Law, carrying a more severe sentence. No distinction

was made between Negligent Homicide and Voluntary Manslaughter inasmuch as from the standpoint of their behavior and the result of their actions there is probably no personality or nervous system difference.

It can be seen that the majority of cases lies between 20 and 50 years of age, so it is apparent from this Table that the presumption that most of the reckless, dangerous drivers are youths is incorrect. At least young offenders showed no evidence of bizarre conduct which would lead the Judge to send them to the Clinic.

Table III is an analysis of the hundred cases according to the Intelligence Quotient as indicated by the standardized intelligence test. In the majority of these cases, the Stanford-Binet Test was used, in ten the Pintner-Paterson Performance Test was used because of illiteracy or reading difficulty, and six cases were not tested—because of psychosis or some other serious neuropsychiatric disorder they were obviously untestable. This Table is a two-way analysis of one hundred traffic offenders, according to their intelligence. The first one is a breakdown according to range of the arrest situation, and, of course, all of the hundred cases were arrested. In the second column under each heading is a listing of the number of cases under each intelligence level

TABLE III  
INTELLIGENCE QUOTIENT, ARRESTS AND ACCIDENTS

	RD		M		D		S		H		HR		Total	
	cases	acc	cases	acc	cases	acc	cases	acc	cases	acc	cases	acc	C	A
100	3	2	1	—	—	—	—	—	1	1	—	—	5	3
90-99	8	4	2	—	2	2	1	—	—	—	—	—	13	6
80-89	14	10	—	—	5	4	1	—	4	4	2	2	26	20
70-79	7	4	4	2	1	—	3	2	1	1	3	3	19	12
60-69	13	9	2	—	1	1	2	2	—	—	—	—	18	12
50-59	3	3	1	1	—	—	—	—	1	1	—	—	5	5
49 minus	5	4	1	—	1	1	—	—	1	1	—	—	8	6
not tested	3	2	—	—	2	2	—	—	1	1	—	—	6	5
Totals	56	38	11	3	12	10	7	4	9	9	5	5	100	69

which had been involved in an accident in addition to the fact that they were arrested, and it can be seen that sixty-nine cases out of a hundred had already been involved in one or more accidents. Since these accidents may have occurred in the distant past, it is unnecessary in the present study of these cases to see what bearing a disorder found on present examination might have had on accidents in the past. We can see by studying Table III that the definitely feeble-minded, those below 70, are not the predominantly accident prone, and that those slightly below the average in intelligence, but still within the normal range group, are quite likely to become arrested. Whether it is probable that the bright ones escape being sent to the Clinic because they made such a good impression in Court or whether they do not get in trouble it is impossible to state. It seems also to be true that higher intelligence does not necessarily mean a violation without an accident, although those of lower intelligence seem to have more accidents in proportion to the number of arrests.

Table IV shows two groups compared with particular reference to isolated neurological findings. The frankly psychotic whose mental condition also was accompanied by gross neurological conditions such as paretics and alcoholics were not tabulated here; neither were the frankly neurological cases. Most of the signs listed above were mild and without a very careful neurological examination might have been ignored; in fact, except for three cases it was necessary to check the findings several times to be sure that they existed. This was also true in the case of the license candidates. Out of the hundred candidates for license none was found to have any frank neurological disorder and only those signs listed in the right hand column were

elicited in the hundred seen. It will be noted that there are more signs listed above than there are cases of violators, less negative cases and less cases with diagnosable gross neurological symptoms. This is due to the fact that some

TABLE IV  
NEUROLOGICAL SIGNS NOTED IN VIOLATORS AND  
IN LICENSE CANDIDATES

	Violators	License Candidates
Achilles (absent).....	1	—
Amnesia (simulated).....	1	—
Aphasia.....	1	—
Asymmetry (facial).....	1	1
Arteriosclerosis.....	5	1
Ataxia (mild idiopathic).....	1	—
Babinski's Sign (left).....	1	(not tested)
Birth trauma.....	2	—
Choked disk (unilateral slight)...	1	—
Deafness (mild).....	3	1
Deafness (bilateral severe).....	1	—
Deafness (L severe unilateral)...	1	—
Epilepsy.....	4	—
Exophthalmos (mild).....	2	1
Finger-nose test (ataxic).....	1	—
Finger-finger test (ataxic).....	1	—
Fractured skull (history of definite residues).....	1	—
Fractured skull (history of no detectable residues).....	1	—
Heel to knee (uncoordinated)...	1	—
Hemiplegia (recovered syphilitic)	1	—
Hyperthyroidism (mild).....	2 (1 very mild)	—
Hypothyroidism (mild).....	1	1
Hyperpituitarism (mild).....	1	—
Knee jerks (accentuated).....	5	1
Knee jerks (diminished).....	3	1
Knee jerks (unequal).....	1	—
Lidlag.....	1	—
Masklike facies.....	1	—
Nystagmus.....	1	—
Ocular muscle imbalance.....	2	1
Poor general coordination.....	2	—
Pupillary defect-Inequality (R>L)	1	—
Slow reaction to both L & A...	2	1
Refractive error.....	14 (total)	8
Including (corrected).....	9	4
Romberg's sign.....	2	—
Slow motions.....	2	—
Strabismus.....	4	1
Tremor.....	10	5
No neurological symptoms.....	24	78

of the cases showed two or more signs and only twenty-four could be given an absolutely clean bill of health as having no signs at all. No particular group of signs was noted except that the case listed as ataxia is also the case that gave the poor response to the

finger-nose test and finger-finger test. There was no consistency about pairing or tripling of any of the signs listed in the left hand column. For instance, poor vision might have been accompanied by absent Achilles in one case and accompanied by nothing in another. It is obvious from this listing that a knowledge of how to evaluate neurological findings properly is of extreme importance to the examiner of traffic violators or accident prone persons, for these mild signs which apparently have very little connection with the situation might be elicited and be over emphasized by the casual observer or neurologically unskilled physician.

TABLE V  
PSYCHIATRIC TRAITS NOTED IN EACH TYPE OF  
OFFENDER

	RD	M	D	S	H	HR
Alcoholism	15	2	9	1	1	—
Assaultive	2	—	1	1	—	—
C.P.I. inadequate	8	3	2	3	4	—
Confused	2	—	1	—	—	—
Cyclothymic makeup	3	—	—	—	—	—
Disorientation	2	—	1	—	—	—
Egocentric	9	1	3	1	1	—
Epileptic makeup	1	—	—	—	—	—
Homosexuality	3	—	—	1	—	—
Hysterical manifestations	3	—	—	—	—	—
Impulsiveness	16	3	2	2	2	3
Infantile	8	2	3	—	2	3
Inferiority feelings	18	5	2	4	3	1
Judgment defect	13	2	2	1	—	3
Memory defect	4	—	1	—	1(?)	—
Negativism	2	—	—	—	—	—
Primitive tendencies	3	—	—	1	—	—
Psychoneurosis (anxiety type)	2	—	—	1	—	—
Recidivistic	2	—	—	—	—	—
Sex maladjustment	4	—	—	—	2	—
Schizoid makeup	4	1	—	—	—	—
Simple adult maladjustment	1	—	—	—	—	—
Suggestible	6	4	4	—	2	1
Unclassified	2	—	—	—	—	—
No demonstrable psychopathy	1	1	—	—	—	—

Table V is a breakdown of all the cases according to predominant psychiatric syndromes or symptoms, with the exclusion of those cases which were frankly psychotic. It is interesting to note the predominance of inferiority

feelings found through the whole group, and it must be noted, too, that here again the number of symptoms or syndromes is greater than the number of cases found. This was due to the fact that there are groups of predominant symptoms, particularly inadequacy connected with inferiority feelings, but it is true, too, that the suggestible group is well distributed through the infantile and impulsive group, but a third or fourth symptom distributes each case individually.

Table VI presents a list of fourteen cases in which a frank neurological disease was detected.

TABLE VI

Cerebral arteriosclerosis	1
Disseminated sclerosis	1
Epidemic encephalitis	1
With Parkinsonism	1
Epilepsy	4
Hemiplegia (slight residue)	1
Lead encephalopathy (mild)	1
Peripheral neuritis (undetermined origin)	1
Polyglandular dysplasia	1
Syringomyelia	1
Undetermined c.n.s. lesion	1

Table VII is a similar list of frankly psychotic cases. It is self-evident that the existence of frank neurological disease and frank psychosis cannot be ignored in the analysis of causes of traffic accidents.

TABLE VII

	RD	M	D	S	H	HR
Involuntional melancholia	—	—	—	—	1	—
Manic depressive	1	—	—	—	—	—
Schizophrenia	2	—	—	—	—	—
Suspected traumatic psychosis (not found)	1	—	—	—	—	—

#### INDIVIDUAL CASES

It would be well here to present a few brief summaries of the neurological and psychotic cases listed above. The fact that these people were on the highway and were undetected in practically all cases, or at least were not warned that their condition made them

dangerous to others, brings into sharp focus the need for neurological examination and psychiatric examination of traffic offenders.

*Case 1.* This was a forty-six-year-old married, white male born in Illinois. He was referred to the Clinic after being arrested on a charge of speeding. The circumstances were as follows: He was driving down a main road at fifty miles an hour and wanted to turn on a certain road. He impulsively went one mile too far and turned around as he passed the street. Just before he turned around, he was accosted by an officer who gave him a ticket for driving fifty miles per hour. After he had reversed his direction he was again picked up, having passed the street a second time, and was given a summons for having violated the speed limit, going forty-five miles per hour. This officer again turned him around and a third officer stopped him at the street where he wanted to turn and gave him another ticket for driving forty-five miles per hour. The physical examination is without any significant material, but the psychiatric examination revealed that he was extremely disturbed. He was highly distractible, broke off in the middle of a sentence, was restless, spat frequently, and walked around the room while he was talking. He was abnormally friendly and overcheerful to the point of euphoria. He stated that he had had a previous mental attack when he was observed in the State Psychopathic Hospital where he had been a patient for about a month. Although he had been out of work for some time, he had a number of grandiose ideas about big companies wanting to consult him, but his stories were not consistent. He was quite argumentative and a diagnosis of manic-depressive psychosis was easily made.

It is easy to see here that his symptoms resulted in gross disobedience of the law, and it was very fortunate that he did not get into a serious accident. With his impulsiveness, his lack of ability to adjust to other people and see their rights, so common in a case of manic-depressive psychosis, he might

very well have deliberately run into another car. His impulsiveness and lack of control, which caused him to overrun his street three times, would seem to be symptomatic of this disease, although the textbook picture of it naturally fails to mention such symptoms.

*Case 2.* This was a man thirty-five years of age, white, single, and born in the United States of German parents. He had had no previous arrests or convictions and at this time was arrested merely for having no operator's license. The physical examination revealed a man of medium size in good general physical condition. All of his motions were quite slow, and his responses to questions and commands were very slow. However, the physical examination was essentially negative and this included the neurological. This man claimed that he had not been driving a car for a long time and his license had been revoked after residence in a state hospital for the insane. On the occasion of his present arrest, however, he was at Police Headquarters with a cousin who was requesting a chauffeur's license. The cousin double-parked his car and the patient felt that he should drive it around so they would not be arrested. He drove the wrong way on a one-way street and when stopped could produce no license and was sent to the Clinic. The psychiatric examination revealed that he was very much out of touch with society. He had a number of manneristic movements of the face and the hands. He talked in a low tone, had an expressionless face, and showed no emotion in keeping with the fact that he was in difficulty. He was not apprehensive and acted as though he thought he had done nothing that should involve him in any trouble. There was some *ceria flexibilitas* and most of his movements were in keeping with the negativism so often found in catatonic cases.

While it does not seem that a great deal of damage was likely to occur in simple driving, nevertheless in a complicated circumstance it is unquestionably true that this man would be

unable to cope with an emergency and would very likely, because of his emotional difficulty, permit himself to have a very serious accident.

*Case 3.* This was a fifty-year-old, married, white woman, born in this country of American parents. The charge against her was reckless driving and the circumstances were as follows: She was driving by a school, in the middle of the road, when a truck drove past so that the patient had to swing around to avoid an accident. She struck two children. The physical examination was not of any significance, but the mental examination revealed that at about forty-eight years of age she began to develop frequent mood changes, and during the examination we found this to be true. She would become affable, then irritable in very quick succession. She admitted delusions of persecution and having many hallucinations. She admitted that at one time God appeared to her from behind a rose bush and instructed her not to pick the flowers. She stated that her mother appeared to her on many occasions and said, "If you could see my father, you would see myself." She stated that the spirit of the father of another examiner was present in the room. She was markedly depressed and was diagnosed as having involutional melancholia of a paranoid type.

Witnesses stated that the accident was an unavoidable one, and it is probable that her abnormal mentality, possibly her hallucination, prevented her from reacting as well as she should have.

*Case 4.* This was a thirty-three-year-old, married, white man born in the United States of German parents. He was arrested for driving through a red light, and he stated that he could not stop in time even though he saw it ahead. He gave a typical history of epidemic encephalitis and stated that in 1923 he was vaccinated and two weeks later had an infection on the back of the neck which developed into a boil. Following that time he was at home in bed for a period of seven weeks during which time he slept a great deal. Upon his recovery he stated that he seemed to be very much slowed up in his physical reactions.

He stated that about a year subsequently "it seemed as though the nerves in my arms were shortening and pulling my arm up." He said that this process continued until now the natural position for his arm was in a horizontal plane. He gave a history of diplopia about a year later and for the past few years he had been getting very much worse. He was cooperative and friendly toward the interviewer, and there was no evidence of psychosis, but there was no question upon physical examination that he had a complete Parkinsonian syndrome, and all of the neurological findings of chronic encephalitis lethargica such as mask-like facies, "reptilian" stare, coarse speech, tremors, festination, retropulsion, yawning, and dystonic movements. This condition would account for his inability to respond to the traffic signal.

*Case 5.* This man was accused of driving while under the influence of intoxicating liquor. He was thirty-nine years of age, white, of Polish descent. The psychiatric examiner made this statement about him: This man was "without a doubt one of the worst messes I have examined for a long time." He could not tell the difference between a tree and a bush except that a bush grew wider. His judgment was poor; he was indifferent to the fact that he smashed into a car when turning out from the curb. He had been in numerous accidents in the past. He was feeble-minded, and in addition, the following neurological findings were noted: "There is a ptosis which is more marked on the right side. There is a marked asymmetry; the left naso-labial fold is more ironed out than the right. His speech is slurring; the uvula is unusually long but in the midline and moves with phonation. The tone of the muscles of mastication are satisfactory. The pupils are somewhat sluggish but do not react to light; they are unequal, the left being greater than the right. The knee jerks are sluggish. There is no ankle clonus. There is deafness in the right ear." It is obvious that a man with such neurological and psychiatric signs as these is a menace on the highway, and the history indicates that he had done much damage in the past. Of course he rated as a mental defective, according to the tests, but these

were inadequate because of the influence of alcoholism on his make-up.

*Case 6.* This was a forty-year-old colored man who came from the south but had been living in the north for some time. He was arrested for making a left hand turn too close to the left curb in such a fashion that it attracted the attention of an officer. One can see why a turn of this sort would be distinctly noticeable. If it had been a right hand turn over the curb, he probably would have attracted no attention, but a left hand turn usually is made around the middle of an intersection, keeping the car completely away from the left curb. The man was referred to the Clinic and upon neurological examination the following was found: The man had an oxycephalic head with a high, narrow forehead and a rather marked exophthalmos which gave him a frog-like appearance. The retinal arteries were moderately sclerosed but there was no evidence of choked disks. The gait was slightly ataxic, and he walked with considerable limp on the left side. There was some spasticity in the left leg. There was marked weakness in the left arm and hand with moderate weakness of the right arm and hand. There was atrophy of the interossei muscles in both hands with a partial claw hand on the right. On the left hand there were scars of multiple burns, some of which were poorly healed, and half of the left index finger had been amputated as a result of an infected burn. Scars of large burns over both shoulder blades were found. There was an old Charcot joint on the left shoulder with marked bone destruction with about two inches of shortening of the humerus. The left elbow was enlarged and apparently fixed from an early Charcot joint. A complete loss of temperature sensation in both hands, arms, and over both shoulders was found. Pain sense was moderately diminished in the left hand but was normal elsewhere. Joint sense and vibration were normal and touch was normal. The tendon reflexes were absent in the upper extremities, somewhat hyperactive in the lower extremities, and there was a positive Babinski on the right side. A diagnosis was made of syringomyelia in the cervical cord. There was also a history of syphilis. His

vision was only 20/50 in the left eye and 20/40 in the right eye. The Kahn test, as well as the Kline, were negative, as a result of treatment. Upon considering him from the standpoint of the history, it was found that there was a paralytic-like condition already in progress in the right arm when this man was admitted to the Army in 1918. He admitted that both arms are very severely paralyzed (the hands are both bent dorsally, and the fingers are kept in an adducted position); and he stated that the positions of the fingers were fixed with him. Although he had the beginning of this condition upon admission to the Army, it only became serious since the War and he was living on a pension at the time of the accident. He had not worked for many years and was married with a family of five, ranging from thirteen to six. When asked how it was that he thought he could drive, he stated he was "only out on Sundays when the wife wanted to go for a ride," and that he knew that the time was coming when he would no longer be allowed to drive. He had been licensed in Michigan originally in 1917 when there was no questionnaire or no examination prior to licensing drivers. Even at the present time the casual lay examiner in any police department probably would have passed him because without expert observation the peculiar posture of the hands would not have been noticed. He had to lock his hands around the steering wheel and could move the wheel only by gross movements of the right shoulder.

It is obvious that a man with a neurological condition like this should never have driven. It is equally obvious that a lay observer could not have prevented him from driving, although a searching questioning might do some good provided the men are inclined to tell the truth. This traffic violation was the result of his inability to move his left arm and make an adequate left turn.

Without giving any more complete descriptions of cases we might note briefly the following types who were observed:

An epileptic. One case was a boy who had had epileptiform seizures about once a month since early childhood. They were more frequent in the past but still continued with some regularity. He showed very little deterioration but did poorly in school. One night when he had attended a party he drove off and stated later that he suddenly awoke and found himself lying by the side of the road. He noticed that a truck and his car were overturned, and it was then that he had had a seizure. He had no memory of what happened but apparently from the account of witnesses, he struck the truck broadside with enough force to knock it over.

Again we might cite a case of anxiety neurosis. This man was a War Veteran who had developed a typical anxiety neurosis a few years after the War. He was treated several times in a Veterans' Hospital and each time recovered and made a good economic and domestic adjustment. On the present occasion he was arrested for going through a red light at 2 o'clock in the morning. The neurological examination revealed nothing. The psychiatric examination revealed a typical picture of anxiety neurosis; a feeling of compression about the heart, conversion symptoms, guilt feelings about his sexual adjustment, and much complex material in connection with his early life. The occasion for the present traffic violation was one night when he had such feelings of anxiety and terror that he felt that he had to get out into the open. He admitted, himself, upon examination, that he was so disturbed over his thoughts and his apprehensions that he failed to pay attention to the light signal, hence was arrested.

It is impossible here to give in full all of the cases of obvious psychiatric and neurological conditions which passed through our hands during this study, but to conclude this section we might cite a case where the neurological condition was serious but yet did not

interfere with the man's driving, for he had been driving for twenty-one years without an accident and had had only three arrests, all for reckless driving. The last arrest was for drunken driving which resulted in his being sent to the Clinic. The officer thought that he was intoxicated because he was so unsteady. He had marked tremors and all the other signs of the unilateral birth palsy. In his case it was recommended that the man's license be revoked, but the reason was not because of his neurological disorder for it was felt that he could drive. His attitude, however, was the important thing, and we quote herewith a part of the Clinic's report to the Judge in this case:

Physical examination reveals that he is a stocky, overweight man, who is 5 feet, 6 inches in height, weighing 182 pounds. His teeth are in fair condition. The heart and lungs are normal. The blood pressure is slightly elevated. The vision is inadequate in the left eye and somewhat poor in the right. He has had a nervous disorder since birth which causes him to make a mechanical motion coming at intervals with various parts of his body. Sometimes these movements are jerky and sometimes they are somewhat retarded. This man, through constant driving, has learned to correct his condition and we should say that while his nervous system is impaired, constant effort and experience enable him to compensate so that he is no more dangerous while driving a car than a man with a normal nervous system. However, psychiatric examination does not result in such a favorable conclusion. He admits that he was driving on the wrong side of the street and he admits he was going forty-five miles per hour. His defense, a poor one in our estimation, was that everybody else does this. On that basis we could quite easily expect to have everybody else violate all the laws with the result of a tremendous loss of life. His unsocial attitude is further revealed by the fact that he has been arrested twice previously for driving without a license, and that he has had numerous minor violations. His judg-

ment is undoubtedly impaired, for it must seem obvious to even one who is poorly acquainted with the general traffic problem and responsibility to others when driving, that a man with a physical defect such as the present patient's, would be even more careful to obey the law and thus establish his right to be on the highway. We question whether a warning will be sufficient to teach this man to use good judgment and if his license is revoked he will probably drive without one. As far as the physical condition is concerned, there is no need to revoke the license.

#### SUMMARY AND CONCLUSIONS

The most important feature of the present series of cases is the indifference of the general public, and also of the medical profession, to the fact that abnormal people are driving, and are probably responsible for a number of the accidents which occur. When one realizes that out of the hundred cases seen here, 69 have been in accidents, one cannot minimize the fact that neurological and psychiatric conditions do play an important part. If one studies Table II one sees the fact which was pointed out above, that the young driver is not necessarily the most dangerous, and that of the reckless driving cases there are just as many in the 40 to 49 year category as there are in the 20 to 29 yet only four of the most acute neurological cases, those listed in Table VI, were in the 40 to 49 year category. Nevertheless, the 30 to 60 year plus category contains most of the cases in the neurological symptomatology table, Table IV. Probably the greatest significance of these facts is the indication that with increasing age there is a beginning of neurological breakdown. Naturally this does not indicate that the breakdown is of sufficient degree to render the individual dangerous when driving a car as indicated by the birth palsy case, but there is some suggestion that these individuals should be

watched. In order to check and see whether neurological cases with some degree of seriousness continue to drive, a simple check was made of the fifty cases in a chronic hospital for nervous disorders. This forms Table VIII.

Twenty-six of these cases had never driven and out of the twenty-four others, six cases had driven occasionally since the actual onset of their disorder. Most of these cases were relatively mild until after they had stopped driving, and they were only sporadic drivers. This would probably indicate that there is almost a self-controlling feature in serious neurological disorders. Certainly that is true in such cases as tabes, paralysis agitans, cerebral hemorrhage, and others of the ilk where locomotion is seriously impaired. If the individual has trouble walking, whether he is intelligent enough to stop driving a car or not seems to make no difference, he cannot manipulate the pedals. The psychiatric conditions were distributed through all ages. The significance of the various psychiatric findings, as indicated in Table V, is largely one of constitution and attitude. It is unfortunate that contrary to the findings in the case of neurological conditions where the individual becoming very seriously ill stops driving, there is no automatic control to make the seriously sick psychiatric case do the same. It would be up to the family, the physician, or the committing agency to see that the man stopped driving until he was incarcerated in a hospital or at least while he was under the care of a psychiatrist. One can see that the reckless driving cases have many more psychiatric deviations than any of the other types in proportion to the other cases seen.

It is a very serious commentary on our present civilization when people who are actually disoriented should be behind the wheel of a dangerous vehicle.

TABLE VIII

Disorder	Duration	Last Driven
1. Paresis	3 years	3 years ago (prior to onset)
2. Tabes Dorsalis	2 years	1½ years ago
3. Chronic encephalitis	8 years	6 years ago
4. Tabes Dorsalis	7 years	17 years ago
5. Paresis	6 years	2 years ago
6. Paralysis Agitans	2½ years	5 years ago
7. Ruptured Aneurysm of the Circle of Willis	5 months	9 months ago
8. Disseminated Sclerosis	3½ years	4 years ago
9. Tabes Dorsalis	4 years	10 years ago
10. Paralysis Agitans	16 years	8 years ago
11. Cerebral Hemorrhage (left hemiplegia)	6 months	7 months ago
12. Chronic encephalitis	5 years	4 years ago
13. Disseminated Sclerosis	6 years	7 years ago
14. Cerebral thrombosis (syphilitic)	7 months	1½ years ago
15. Tabo-paresis	2 years	2 years ago (not since onset)
16. Paresis	2 years	2 years ago (not since onset)
17. Disseminated Sclerosis	1 year	2 years ago (scared because of my dizziness)
18. Tabes Dorsalis	1 year	8 months ago (work was driving a taxicab and quit "because of my legs")
19. Alcoholic neuritis	1½ years	1½ years ago (I couldn't walk so I couldn't drive)
20. Disseminated Sclerosis	4 years	4 years ago
21. Paresis	1 year	1 year ago ("I fell and lost my way then and came here")
22. Paresis	3-4 years	1 year ago ("I drove until I was admitted here; was sick 2 years")
23. Paresis	2 years	2 years ago ("I taught my wife to drive; never had to since I was sick")
24-50. Never drove—either before or after onset of their illness.		

How on earth they could remember the traffic ordinances sufficiently to keep out of trouble is a question that must immediately arise. We have indicated in the discussion of individual cases the significance of an anxiety type of psychoneurosis, and the same considerations must hold true where there are hysterical manifestations, epileptic make-up, or confusion. It might be pointed out that out of all the cases seen, there were only two cases where the psychopathology could not be demonstrated. Obviously this is partly the fault of the present method, but it does indicate that if these deviates can be so easily picked out by a layman, namely a Judge, a multitude of them must be driving in traffic in any large city or even in the country who cannot as easily be isolated but will certainly give rise to some difficulty sooner or later.

The question, of course, will arise whether our standards in making the

present criteria are not too harsh. It is not the feeling of the members of the Clinic, who staffed these cases after they had been checked by several examiners—as well as the writer—that the Clinic was too harsh in making its diagnoses; and that probably by using the same criteria ninety-five out of a hundred of the general population would come through with at least such mild psychopathy as not to be recorded and probably would be considered normal. Of course the homosexuality and the sex maladjustment noted in Table V *per se* do not mean that these individuals are dangerous in traffic, and this possibly is quite true with the cyclothyme and the schizoid individual, but unfortunately these conditions were also accompanied by other more serious characterological deviations so that their presence was an aggravation rather than a mere characterization.

Tables VI and VII are self-explana-

tory. It is obvious that individuals with most of these neurological and certainly with all of these psychiatric conditions should not be behind the wheels of automobiles. There is a question in our minds whether perhaps the epidemic encephalitis cases might not drive if their motility is not as diminished as it was in the case described under Individual Cases, and it was not our feeling that the lead encephalopathy case was sufficiently severe to interfere with the man's driving except that, as in the birth palsy case described above, the lead encephalopathy was accompanied by serious mental manifestations which would make the man aggressive, impulsive, and one who would use poor judgment in an emergency.

As far as the visual defects which were noted under the neurological signs tabulated in Table IV, the choked disk case merely required referral to a physician. His attitude and general make-up were such that with treatment for his general physical condition it was thought that he could resume driving a car. The strabismus cases were naturally referred to an oculist inasmuch as it was felt that some could and some could not drive cars. The pupillary deficiencies and refractive errors were judged on their merit because it was not felt that either of these symptoms alone should prevent an individual from driving a motor car. It has been the experience of several observers working with candidates for driver's license and with offenders in our Clinic that the usual criteria for visual deficiencies are not fair toward the driver, that the ability to see is a fairly flexible one, and the individual even with only one eye very often can develop enough insight if he is sufficiently intelligent so that he can compensate for lack of mere stereoscopic vision. The usual tests for stereoscopic vision, judgment of speed and distance

as devised by the psychologists, probably are not of very great significance. Loss of sufficient visual acuity or sufficient muscular balance seriously to interfere with a man's driving ability would produce such symptoms that, as in the serious neurological cases, the man would probably be forced to stop driving in any case.

The matter of intelligence brings up a final point. As far as we are able to determine from the facts brought out in the present study, one can conclude that the mere presence of a neurological symptom or a minor characterological deviation should not be sufficient to interfere with a man's driving, provided he is aware of it, and the type of intellectual deviation is not such as to render his judgment bad. However, when one glances over Table III one sees that there is such a preponderance of those of low intelligence that there would be a considerable question whether their intellectual capacity was such that they could compensate for the difficulties in other spheres. Of course more extensive studies of a similar nature to the present one will naturally be required with a more disparate sampling, including many more non-violators and minor violators.

In the introduction it was pointed out that this is a study made to find out whether sufficient gross defects are present to make further studies worthwhile. We may conclude that:

- 1) There are a sufficient number of gross deviations, both neurologically and psychiatrically, to make it worthwhile to examine large groups of drivers.

- 2) Very serious defects can be noted in drivers, although there is a tendency when these defects become sufficiently serious, particularly in the neurological conditions, for the individual to stop driving.

- 3) There is an age influence, in that

those individuals as they grow older show more neurological conditions, particularly severe ones which might stop them from driving, and that a group such as the license candidates composed of younger individuals shows many less, even minor, neurological symptoms.

4) There is considerable distribution of neurological findings through a random sampling of serious violators.

5) There is a very definite relationship of psychiatric deviations to major violators so that the preponderance of individuals brought into a Clinic for examination because of their attitude in Court are found to have serious symptoms.

6) Feeble-mindedness cannot be ignored for it can be found among traffic violators, and the feeble-minded do have a slightly greater number of accidents than the general run. It would seem from the present study that the preponderance of serious violators are below average in intelligence, although not necessarily feeble-minded.

7) Intelligence and accidents would seem to have the same relationship that intelligence bears to violations.

8) There would be no question

from the above findings that the matter of neurological and psychiatric deviations in traffic violators, and probably in motor car drivers as a whole, is deserving of very serious consideration. The matter is far more serious than the population as a whole has been willing to recognize. Neither the neurological nor the psychiatric condition of the individuals involved in either traffic violations or accidents can be safely ignored in the future.

9) The problem would seem to lie very definitely along the lines of medicine and not as much, certainly, along those of psychology which has hitherto made the approach to this problem.

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## A STUDY OF MECHANISMS IN TWO CASES OF PEPTIC ULCER

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### PRESENT CONCEPTS OF THE ETIOLOGICAL SIGNIFICANCE OF EMOTIONAL FACTORS IN PEPTIC ULCERS

A PSYCHOANALYTIC approach to the understanding of the relation between emotional disturbances and the occurrence of gastric disorders, in particular of peptic ulcer, was first made by Franz Alexander in 1931 (1). He inaugurated further research at the Chicago Institute for Psychoanalysis on a group of patients "with obvious personality problems" and gastric symptoms (six cases of duodenal ulcer and three of gastric neurosis). The preliminary results together with illustrative case histories by Catherine Bacon and Harry B. Levey were published in 1934 (2). The "psychosomatic" concept developed in those studies [see also Alexander (3)] may briefly be reviewed as follows:

Under the influence of certain unhappy experiences, interfering too much with a natural development, a child can be forced to fall back in its emotional maturation. This may sometimes increase such wishes as to be cared for, to be loved, to depend on others, to receive, and—if thwarted—to take aggressively (regression to oral receptiveness and oral sadism). Whereas the ego reacts to such tendencies with feelings of inferiority and guilt, these are repressed from consciousness, sometimes under seal of a strong overcompensation, manifest as in independ-

ent, efficient, later responsible and giving attitude in life. This type of "conflict-solution" was regularly found in the gastric patients whose unconscious longing for care, love and dependence could not be concealed from the analytic observation. Next to the described internal reaction, sometimes external factors were found to be capable of maintaining a fatal frustration of those infantile cravings. The latter, obviously, once in life are perfectly gratified, namely at the time of being nursed, when almost indistinguishably love and food are abundantly offered; Alexander states: the wish to be loved becomes emotionally associated with the wish to be fed. If wishes for care and dependence are now strongly repressed, we may assume that these easily activate, or rather are "converted into" the desire to be nourished, which as a continuous unconscious psychic stimulus, influences the secretory, muscular and vascular condition of the stomach by means of the vegetative nervous system until it behaves "as if it were taking or were about to take food." Such chronic functional gastric disturbances, besides being likely to cause neurotic stomach complaints, appear to be of essential importance for the development of gastric and duodenal ulcers.

This theory about psychogenic factors in gastric disorders and peptic ulcers did not spring simply from some isolated psychoanalytic observations and understanding, but is equally based upon important data from phys-

\* The author was enabled to make this study at the Chicago Institute for Psychoanalysis through a fellowship from the Rockefeller Foundation.

iology and pathology, e.g. the "psychic" gastric secretion (Pavlov's experiments), the rôle of hyperacidity and hypermotility in the pathogenesis of peptic ulcers (the mechanical-functional theory to which von Bergmann (7) himself lately added the factor of local ischaemia and "neural" influences), and the observations of peptic ulcers after parasympathetic stimulation by operative irritation of the midbrain [Harvey Cushing (14)] or by pilocarpine injection in the ventricles [Light (26)]. On the other hand the psychoanalytic findings threw a new light on the valuable observations of Draper and Touraine (18) who described "femaleness and masculine protest" in their male ulcer patients [later reemphasized by Daniels (16)]. Moreover a pattern of a psychogenesis of an organic disorder was suggested: emotional conflict, related to the function of a certain organ—specific stimulation of subcortical centra—alteration in the vegetative innervation of the involved organ—dysfunction of the organ which, if chronic, finally results in an organic, morphological change (4).

Thus Alexander described a "central" origin for gastric neuroses and peptic ulcers, though admittedly dealing with only *one* factor which may coincide with others, partially still unknown; he also stated: "There is no evidence whatsoever that other cases of peptic ulcer may not develop on a different and perhaps non-psychogenic basis" (2). Finally, in contrast to some other authors, Alexander pointed at the described specific type of the emotional conflict rather than at a certain type of personality, although of course in some individuals the typical conflict may have become predominant and chronic.

That functional disturbances of the stomach, considered as a *conditio sine qua non* for the development of gastric ulcers, can be caused by other than

local factors (in which most pathologists were chiefly interested) revived once again the theory of Rossle; i.e. "gastric ulcer is only secondary to a distant primary disease process." Thus increasing attention was paid to psychic factors as well as to neurological processes. In the American literature since 1934 there have been numerous papers dealing with gastric neuroses, nervous indigestion and the "nervous etiology of peptic ulcers": most of them show clearly a discontent which the clinician feels concerning the treatment of his stomach patients. In general they express as much conviction that the trouble may be emotional in origin as embarrassment and inability to cope therapeutically with this psychological factor. Others [Rivers (29), Crohn (12, 13)] simply stress the noxious tension of hasty, modern life; authors like Walter G. Alvarez (5, 6), David C. Wilson (36) and Emery and Monroe (20), although deserving particularly the merit of teaching the anamnestic recognition of the neurotic background in stomach disorders, furnish little information so far as the specificity of the neurotic process is concerned. Remarkably, in the American Gastro-Intestinal Association the subject was presented twice by psychiatrists William C. Menninger (27), and Earl Danford Bond (8).

Meanwhile at the London Tavistock Clinic, Daniel T. Davies and Macbeth Wilson (17) took the life histories of 205 unselected ulcer patients, paying special attention to the external events preceding the ulcer symptoms in new cases as well as in relapses. They found that in 84 per cent the symptoms began soon after some incident affecting the patient's work or finances or the health of his family (only 22 per cent of a control series of patients with hernia gave history of such events). In most of their patients the anxiety preceding the

dyspepsia (which the authors consider as the onset of the peptic ulcer) was related to "insecurity, money difficulties, increased responsibility at work, the possibility of dismissal and so on." From some of their brief case histories, however, one gets the impression that the so-called "external events preceding the ulcer symptoms" were rather critical threats to the balance of that particular conflict-situation which Alexander described as typical for ulcer patients. Accordingly, from the Mayo Clinic, after Alvarez and Rivers, Eustermann (21) most recently stated: "In peptic ulcer the causative factor, operative in the vast majority of the cases is the psyche, mediated through the autonomic nervous system."

Steigmann (33), a supporter of the last view, could prove that, regarding the negro population of Chicago, peptic ulcer does not have such a racial selectivity as formerly was believed [Robinson (30)]. Negroes living for more than five years in the city, under the same stress and strain of responsibility as the whites, have ulcers just as well; the author claims that in particular their "environmental conditioned psychic factors," effecting an autonomic dysbalance, make them different from the ulcer-free colored population elsewhere. Similarly Kouwenaar (25) threw some light on the frequent occurrence of ulcers among Chinese in the tropics, contrasting to the Javanese who rarely have them. Both the Chinese and Europeans, on coming to live in the Dutch Indies, are susceptible to several disorders depending on a vegetative autonomic dysbalance—diseases which seldom or never are observed among the native population. Kouwenaar, who is well acquainted with the ways of living of different races, assumes that the Javanese who generally show so little emotional expression, also have a much more stable

vegetative autonomic system, less sensitive to different stimuli.

Significant, although not dealing directly with the pathogenesis, is an "experiment" of Chappell and co-workers (11) who treated ulcer patients with group psychotherapy—teaching them to control their worries as well as the discussion of their complaints and "to limit their efforts to master themselves." Although 15 patients from their group of 32 dropped out, the authors claim remarkably good results, checked after three years and compared with a control group of 20 patients who did not have this kind of treatment.

#### CASE HISTORIES

In this paper the history of two patients, whose psychoanalyses enabled a fairly precise reconstruction of the psychological setting of previous attacks of peptic ulcer, will be briefly reported. Since both analyses were undertaken for other complaints and ran over a long period of time, no claim will be laid on completeness, and psychoanalytic details will be given only so far as needed for the understanding of the typical personality conflicts.

#### CASE I

An American born salesman, thirty years of age, came to the Institute on his own initiative, complaining of lack of success in business which he attributed to a "defeatist" attitude. In spite of his intelligence and pleasant personality—in school and games as well as in different jobs—he has never done very well and has continuously worried about becoming a failure. He has been married for two years.

In the introductory interview the patient emphasized continued quarrels with his apparently eccentric and paranoid mother; he also referred to the good relationship with his father from

whom, however, he would never be able to ask financial aid. In spite of the overt preference which, according to the patient, the mother always displayed for the brother, six years younger, he did not feel resentment against the latter. Instead, he rather admired this brother for his more successful development. The medical history revealed gastric complaints more than one year ago and a Roentgenogram, made at that time, showed "an ulcer of the first portion of the duodenum which extended into the pylorus of the stomach." Because the patient refused to remain in the hospital, a gastric analysis could not be made, but under a mild diet the complaints of pain disappeared. He continued, however, to have occasional distress and heartburn until he came for analysis when a careful examination gave no longer evidence of organic changes. X-ray disclosed normal visualization of the gall bladder without stone, normal oesophagus, stomach and duodenal bulbs. The Ewald free acidity was normal, 62, and the stools were negative for occult blood.

Accepted for analysis as a research case, the patient displayed an initial resistant attitude which, as in so many cases, was rather in contradiction to his good insight, but quite characteristic of the neurosis. Long talks about big business and outlooks for getting a mighty bonus, attempts to impress the analyst with stories stressing masculine efficiency, and expressions of contempt for the "sentimental" treatment, filled many hours. This lasted until it could be shown that this behavior served only the purpose of hiding an extreme sensitivity, an attachment to the analytic procedure which the patient considered as weakness and a sign of femininity. Yet gradually he became freer in speaking about his fear of becoming a hypo-

chondriac like the quarrelsome and unhappily married mother, about sharing his father's marital misfortune, and his originally repressed jealousy of his brother. Later he confessed an intense strain of forcing himself to fulfill his business duties, displaying a great discontent at not succeeding as perfectly as he wished (quite similar to puberty worries about defeats), and finally his dissatisfaction with the marriage, newly complicated by the first pregnancy of his frigid wife.

His neurotic marriage and its background are of significance. The patient had married, secretly and without love, a girl who was the daughter of a very wealthy man. The reason for the secrecy was definitely a fear of not being accepted by his father-in-law, who rightly could have been suspicious of some money interest. Another motive for a hurried marriage was that the patient wanted to escape further involvement in a homosexual experience into which, against his conscious wish, he had been dragged shortly before. Marital sex relations were very unsatisfactory; however, the premature ejaculation and anxiety which the patient used to have in former adventures with rather uninhibited girls, disappeared.

Once married, the patient began to realize the hopelessness of the situation in which he found himself. He resolved to make the best of it and decided that he would not take advantage of his wife's money; but in spite of his effort to live up to this intention he lost his position. Meanwhile both the parents of his wife had died. At that time the patient was fighting for his existence and accepted an exhausting job in a factory under unfavorable conditions. Shortly after, it became known that by some testamentary disposition his wife could not touch the inheritance for many years, the estate having been put into a trust fund and the

guardianship given to a relative. It was at that time that the stomach complaints developed, whereupon the ulcer was diagnosed.

In the analysis the crisis which preceded the occurrence of the ulcer could be recognized as the real acme of the patient's conflict situation. Pressed by guilt feelings because of his marriage for money, he tried to deny to himself his dependent wishes and leaned over backwards in his desperate fight for an independent existence. The more he struggled to repress those wishes, the stronger the wish for protection grew in his unconscious. As the expected inheritance meant a source of security, the will came as a sudden blow to the patient. Money meant being cared for; it was unconsciously linked with nourishment. The functional disturbance of the stomach was the logical somatic reaction to the acute emotional conflict which centered around "getting and taking" tendencies. This typical, deep-seated conflict, which was activated by the frustration he experienced in the will of his father-in-law, however, had a deeper foundation leading back to his childhood.

Until his sixth year the patient was an only child and, as his father used to be away on business trips most of the time, he lived quite closely to his mother who let the child sleep with her. She was a woman of poor self-control and had both a seducing and a frightening influence upon the little boy. With the second pregnancy, however, much in her behavior changed; she began to be impatient with her older son, used to spank him and, in an irresponsible and conspicuous way, turned all her love and care to the younger child towards whom the patient developed an intense envy. Shocked and frustrated, he directed his need for affection to the father. At that time he had frequent nightmares and his father

often had to stay at his bed in order to calm him down. He began to suffer from enuresis (which disappeared only in puberty when wet dreams occurred) and renounced his boyish masculine strivings. The analysis revealed that in this way he competed with his mother for his father's affection. Meanwhile he assumed an affectionate and protective, almost mother-like attitude, towards his younger brother. Thus he overcame his envy and intense hostility against the baby, the first reaction against the little newcomer; the earliest recollection was how he hated to give the bottle to his brother. This method of overcoming hostility against the brother by assuming the rôle of a mother formed the basis for latent passive homosexual tendencies and also intensified the wish to receive. He was generous towards his brother but in exchange he demanded love and care from the adults. The intense receptive claims, however, were not only frustrated but also became incompatible with his further development, and thus a strong reaction in the direction of independence took place. The patient tried not to lean any longer on either of his parents, and went on his own way. Successfully, but with much inner fear, he beat up one of his schoolmates, secured a job of selling newspapers when he was seven, and accepted work many times too hard for him in spite of the fact that he feared a physical breakdown and longed intensely to stay home. Without any real need for it, he became extremely eager to make money which he always handed over in full to his parents, but inwardly he resented the fact that he did not get any pocket money in return. Thus he worked his way through high school and college, living a life which was exactly the opposite of indulging in those receptive wishes which in his childhood were intense but which

he had to give up so abruptly at the arrival of his baby brother.

In his marriage the patient relived the same sequence of emotional changes. Before his marriage he gratified his passive wishes in a relationship with a male friend, which ended up in an incidental homosexual experience. He exchanged this form of passive gratification for dependence on a wealthy girl. This, however, he could do only in a disguised fashion. As in his childhood, he had to overcompensate for his secret parasitic tendencies by an overt and exaggerated sense of responsibility and a desperate effort to earn money in order to become independent of his wife's wealth. He kept his promise of not taking advantage of his wife's money, and struggled hard. However, his marriage to a woman whom he did not love became nothing but a source of suffering. She was on such bad terms with the patient's parents that finally against his will he ceased to see them. He questioned his wife's feelings and interpreted her frigidity (quite correctly) as the expression of an unconscious rejection. When in this situation his wife became pregnant, this meant to the patient only a new responsibility, a new and unwelcome tie to his wife. When, during the course of the analysis, a son was born, the patient was overwhelmed with contradictory feelings: sincere parental affection and, less consciously, envy of the love and care which was given to the newborn. That the old death wishes and oral envy towards his baby brother, with all its conflicts and compensatory reactions, were revived in this relation, seems clear in the following dream: The patient's wife bore twins, but one was born five months later after it had already died. However, when the patient looked at it, as it lay wrapped up, it started to breathe; he saw that its legs were all right, was

happy to see it alive, and ordered that it be fed immediately.

The intimate unconscious relation between the different manifestations of receptivity, getting affection, care, financial help, and food, appeared in the analysis with extraordinary clearness. Acute pecuniary disappointments in business were frequently forgotten with the help of a "consoling" good meal and drinks, among which the rich and substantial "Tom and Jerry" was a favorite. Similar oral needs appeared when he suffered any rebuff. In his emotional relation to the analyst, the repressed demanding wishes began gradually to manifest themselves in numerous demands for exceptional favors. One of them was to be totally released from the modest fee which, at first, the patient himself had fixed, at a rate too high with respect to his income. During the course of the treatment there was generally no evidence of dyspepsia in spite of the fact that the patient took average meals without any dietetic restrictions. Acute stomach complaints, however, could be observed many times occurring precisely when he was exposed to hardship or frustrated in his dependent receptive wishes. This correlation became extremely clear when, on the request of the analyst, the patient checked the times he had to take milk of magnesia tablets. Also, it became obvious that stomach symptoms occurred whenever, for external reasons, he had to cancel a badly needed analytic hour.<sup>1</sup>

To summarize briefly: after a period of early spoiling by the mother when the birth of a brother caused an abrupt frustration of needs for care and love, the patient turned his affection to his father, which caused trends of a pas-

<sup>1</sup> Whereas the patient is still in psychoanalysis, the unquestionable decrease of his gastric complaints may not yet be considered as a definite therapeutic result.

sive nature in him. Further, the intense hostility (oral envy) which he had developed against the baby necessitated a strong defense mechanism. This consisted of displaying a generous motherly attitude towards the brother which again reinforced, regressively, his own oral receptive cravings. The passive and dependent wishes, however, were even in their sublimation so obnoxious to the patient that they had to be overcompensated as much as possible by exaggerated ambition and drive toward independence. The repressed tendencies seemed to have found their expression in the somatic area in the excitation of the stomach functions. The gastric symptoms occurred particularly when the compensatory efforts were excessive and the gratification of his oral wishes thwarted.

It is obvious that in our patient the repression and overcompensation of the receptive-demanding attitude were not always successful in keeping it from consciousness. Alexander (2) found this to be even more outstanding in two cases which showed "early and extreme deprivation in childhood." In the case here described there was not such an extreme oral deprivation in childhood. Yet the strongest objection which the patient ever made against his mother was that she always failed to prepare the meals carefully, rather neglected them, so that the boy felt envious of the superabundance which he supposed his schoolmates got at their homes.

Better established and more rigid were the defense mechanisms dealing with the same conflict in another patient about ten years older.

#### CASE 2

This man, married for more than seven years, was referred because of impotency and several hypochondriacal complaints. Although conspicuously neu-

rotic and having since puberty suffered from feelings of depression and inferiority, he had gone through a university successfully and kept a good position as an industrial director. The medical history revealed a gastric ulcer diagnosed ten years ago, but at the beginning of the analysis the patient suffered only from occasional slight dyspepsia; this complaint ceased almost entirely after one year.

Somewhat previous to the analysis, after the death of his parents and a brother-in-law all of whom passed away in a short period of time, the patient (who did not have brothers) had felt obliged to take over a number of consequent responsibilities. Among them, the care of an elderly maternal aunt and the guardianship over the son of his only sister appeared to be special burdens. However, he welcomed such duties, took them for granted and performed them with the utmost reliability in a generous and self-sacrificing way. In the analysis it became clear that this trend to assume responsibilities dated far back in his childhood. When the patient was about eleven years of age his father, a tall, once mighty and commanding man, developed an eye disease in addition to his serious deafness which, after an operation, blinded and wrecked him definitely. At that time the patient had to give up his boyish pleasures and had to assist his mother in financial matters. Eager to have full responsibility, he hurried through the university and graduated at an exceptionally young age. He acquired the reputation of being unselfish, painstaking, exact in the administration of the estates of others, of supporting unsuccessful members of the family and secretly granting help for the study of the children of his and his father's employees, to whom he acted as a just and severe guardian.

His impotency, mostly an impotentia ejaculandi, was the final outcome of a highly disturbed sexual development, dominated by extreme passive trends. Neither masturbation nor coitus attempts could ever bring about an ejaculation; only rarely did he ejaculate through certain passive masturbatory practices or in dreams. This disturbance was based upon a deep-seated fear connected with the female sex organ and a strong narcissism. The analysis revealed a period of uninhibited sexual activity in infancy consisting chiefly of urination in front of, and upon, the one and a half year younger sister and mutual masturbation with her, which behavior ended quite suddenly at about the age of six. At that time the vague threats of the mother (because of his masturbation) were dramatically materialized by a tonsillectomy without anaesthesia (in this procedure, still in use on the continent, a single instrument pinches and cuts off a part of the tonsil). Consequent to this trauma, the boy developed enuresis and fear of darkness, became docile, shy and virtuous. Thus, after the renouncement of his aggressive tendencies and the assumption of such a passive and feminine attitude, it was only natural that he became envious of his sister. Later, the patient went through a similar emotional sequence. At the approach of puberty his pity for the defectiveness of his father inhibited the development of natural competitive feelings and increased his unconscious sense of guilt, but besides, made him renounce all demands on his mother who gave all her devotion to her blind and deaf husband. Under these conditions, the patient became easily the object of the activity of a much older homosexual cousin.

Meanwhile, because an overcompensatory mechanism began to operate,

the envy towards the sister gave way to a devoted protective attitude towards her. During university years the patient kept in close contact with her and had vivid fantasies of establishing a home to live with her in the future. Consequently when she surprised him by getting married he felt very unhappy and forlorn. Shortly afterwards he graduated, and developed an affection for a maternal cousin. He was too inhibited in his sexuality to marry her, however, and gradually settled down to a bachelor's existence (later, he did not fail to support the same cousin and her husband). During this period one of the directors, an efficient but happy-go-lucky man, had won the patient's admiration and attachment and now this man became the object of his latent passive homosexual wishes. Although he violently rejected them, these feelings made the patient's social adjustment difficult. Thwarted in every emotional gratification, his cravings for affection became more and more intense.

The gastric complaints, heartburn and typical pains after meals, occurred at that time. Finally when occult blood in the feces was found, a gastric ulcer was diagnosed and the patient underwent a Sippy-cure. He moved into his sister's home and was taken care of by his brother-in-law, a well known physician. Those two months under the tender care of his sister meant a real gratification of his strong needs for attention, care and love, which the patient could not satisfy in his usual life. During this happy period the ulcer healed completely, but true to his nature, the patient could not remain in debt and before he returned to work he treated his benefactors to a long and expensive trip. Two years later, after much doubt and hesitation, he married a cool and reticent girl who was not, and could not be, in love with him.

The patient's relation to his sister's son was most revealing in showing the deep seated conflict between his wish to be spoiled and loved by his sister alone, to the exclusion of his cousin, and his tendency to assume a responsible and adult rôle. He did many favors for this cousin but his hostility against him came to expression in the form of a neurotic symptom; he developed writer's cramp while writing a letter of recommendation on behalf of the cousin.

Superficially the patient showed an extreme modesty; for example, on his birthday he refused to see relatives or friends for fear they would give him a present. Also, in the beginning of the analysis his behavior was characterized by modesty and complaisance. Occasional outbursts of hostile feelings served as a defense against too much passivity, a reaction to the psychoanalysis, described by Lewis Hill (22) in persons who in early infancy had experienced an acute and painful rejection of their needs for love and dependence by a mother.

Summarizing, we may say that early in life under the influence of several factors, this patient renounced his aggressive impulses, becoming extremely passive and repressing strong oral receptive and aggressive tendencies. Later he was well defended against his sexual impulses by feminine identification and consequent impotency, but against his oral tendencies he had to build a complex system of defense mechanisms in the form of overcompensatory generosity and responsibility.

In the neuroses of the two male patients, the typical emotional conflict and character traits, as described by Alexander and his co-workers, were outstanding. Obvious in different phases of life, this could be observed over and over again in the course of the psychoanalysis. The following com-

mon features were particularly striking:

1) Both patients withdrew quite acutely from infantile sexual activity and became passive, submissive children, attached to their fathers without evidence of much identification with them, rather competing with their mothers.

2) The growing strivings for affection from the father created a mounting tension through a conflict with the so highly different standards of the environment which required the opposite of being a sissy. A reorientation on a more primitive stage, therefore, took place, consisting of a regressive reinforcement of oral trends. Thus the passive-feminine attitude was pushed into the background in favor of an oral dependent one.

3) Those inner changes required a definite renouncement of aggressive impulses, but in the unconscious the aggressive tendencies were maintained and expressed in dreams in the form of fantasies of grabbing and taking hold of things in a forceful aggressive manner (oral aggression).

4) When the passive-dependent wishes were directed towards men, a homosexual coloring was the result; although they were not overtly perverse, both patients showed obvious latent homosexual tendencies in later life.

5) Finally the guilt about the grasping tendencies and the intense rejection (out of prestige) of the wishes for dependence led into a strong overcompensation which brought about the described character traits of generosity and sense of responsibility.

6) Stomach complaints, preceding the occurrence of an ulcer, occurred in both patients when the incongruity between the overt behavior (struggle and ambitious efforts for accomplishments) and the repressed longings for dependence, became excessive.

## DISCUSSION

Concerning the psychogenic factors in gastric ulcer, there still remain a number of questions to be answered. Among them prevail: the possibility of other factors involved, the clinical differences between the presumed psychogenic and non-psychogenic peptic ulcers, and the significance of a preceding gastric neurosis in some, but not all cases. However, there seems to be no longer any doubt about the rôle of the autonomic nervous system as the transmitter between emotional disturbances and the stomach function, as stated in 1932 by Harvey Cushing (15): "vagotonic persons through emotion or repressed emotion, incidental to continued worry or anxiety and heavy responsibility, combined with other factors such as irregular meals and excessive use of tobacco, are particularly prone to have chronic digestive disturbances with hyperacidity often leading to ulcer." He suggested that stimulation of the interbrain ("a long overlooked station for digestive impulses, easily affected by psychic influences") and in particular of the tuberal nuclei of the hypothalamus, may disturb the autonomic innervation of the stomach in such a way that hypersecretion, hypermotility, hypertonicity, and local anemia render the mucosa of the stomach digestible by its own juice.

Cushing mentioned "vagotonic persons" as predisposed to this mechanism but, pointing at the surgical stimulation of the parasympathetic nucleus tuberis, he said: "or what theoretically amounts to the same thing, a functional release of the vagus from paralysis of the antagonistic sympathetic fibres." Without entering into a discussion of the concept of so-called vagotonia, it may be stated that not all individuals with peptic ulcers have such a vagotonic constitution, and also that the

significance of a "local vagotonia" of the stomach (regarded by some authors as a constitutional-etiological factor) seems questionable; comparing the Javanese with other races, Brummelkamp (9) found that their more stable vegetative-autonomic constitution (25) is accompanied by a local, vagal hyper-tonus, manifest in a hyperacidity and quicker emptying of the stomach, although, as said, in the Javanese, gastric ulcer is rare.

The Balfour lecture of Cushing on the interbrain and peptic ulcers paved the way for numerous studies in neurophysiology, focusing on the pathogenetic problem; some of them clearly show the importance of a disturbance of the sympathetic innervation for the development of peptic ulcers. Watts and Fulton (34) and Hoff and Sheehan (23) succeeded in causing multiple haemorrhagic lesions in the gastric mucosa of monkeys through hypothalamic injuries. According to them the affection of the first in "the complex balance between sympathicus and parasympatheticus" would result in a local vasoconstriction, gradually considered as a pathogenetic condition not less important than the vagal hypersecretion and hypermotility.<sup>2</sup> Keller (24) showed that cerebral lesions do not cause bleedings in the stomach wall if the sympathicus chain is removed beforehand. Thus it becomes more and more probable that in the pathogenesis of the peptic ulcer, rather the autonomic

<sup>2</sup> Recently Donald Sheeman (The hypothalamus and gastro-intestinal regulation, Research Publication, Assoc. for Research in Nervous and Mental Disease, Vol. 20, 1940) concluded "It is suggestive but not proven that the gastro-intestinal changes are due to an over-active sympathetic center in the hypothalamus probably caused by irritation from the adjacent injury." He also discussed certain differences between the true peptic ulcer and the gastric lesions through hypothalamic injury but stated that the motility of the gastrointestinal tract and the amount and nature of the digestive juices are under the direct influence of the hypothalamus.

innervation of the stomach as a whole is upset. This also follows from the experiments of Orndorff (28) and co-workers who, by means of pilocarpine-intoxication of dogs, caused hypersecretion and hypermotility but failed to obtain ulcers. The authors admit that whereas they did not implicate the sympathetic innervation of the stomach directly, vascular changes in the stomach wall were lacking. George Draper (19), studying the electrocardiogram of ulcer patients, also states that even in people "with ulcer-constitution the whole autonomic nervous system is highly tense and labile, although the slow pulse, sinus arrhythmia and prolonged P. R. interval possibly indicates a peculiar vagotonicity."

The experiments of Silbermann (32) who succeeded in causing gastric ulcers in dogs by sham-feeding (esophageal fistula) were repeated in 1937 by Schmidt and Fogelson (31). In spite of strong acid reaction, their ten dogs did not develop ulcers. In accord with the observation of so many patients with hyperacidity and no ulcers, the authors are inclined to believe that other factors than hypersecretion must be involved and attribute the findings of Silbermann to malnutrition and vomiting of his animals.

Brummelkamp (10) observed pyloric ulcers through starvation in rats; alkalization prevented them. Fasting of cats, however, did not cause ulcers unless by means of hydrochlor-morphini, a pylorospasm and hypersecretion was simultaneously effected. The author gives the following explanation for the different effects of fasting in rats and cats: the first, being rodents, are accustomed to chronic digestion, whereas to the beasts of prey intermittent hunger is an experience to which their organism is adjusted. The last distinction reminds us of the need for frequent feedings in sucklings and small chil-

dren in whom, because of the process of growth, the oral-receptive function is so predominant. The regression which was shown to have taken place in our ulcer patients, causes a continuous unconscious longing for dependence and special cravings for getting by mouth. This is believed to stimulate the stomach continually which then finally acts similarly to that of the starving rodents, and thus becomes particularly prone to the development of peptic ulcers.

Still more comparable to what supposedly goes on in persons with "ulcer conflicts" are the experiments done by Wilhelmj and co-workers (35). By means of a stomach pouch in dogs, they examined an intragastric process, *i.e.* the local inhibition of the gastric secretion by the presence of 0.1 norm. hydrochloric acid in the empty unstimulated part of the stomach. They not only tested this inhibition during digestion when food was in the other part of the stomach (gastric phase) and during the intestinal phase, but extended the research to the "psychic phase" by presenting to their animals food which only after a period of time could be taken in the mouth and swallowed. It was found that the gastric secretion during this phase easily can break through the inhibitory effect of the presence of hydrochloric acid which in the same concentration totally prevented the acid secretion during the gastric phase. They concluded, therefore, that the secretory energy of the psychic phase causes a degree of hyperacidity, unobtainable by one of the two other phases.

In view of the complexity of the human psychic conditions, the work with animals, on the whole, does not offer a satisfactory imitation. Nevertheless, the last described Tantalus experiment, in the psychosomatic respect comes closer to the mechanism of an

intensified "ulcer-conflict." The frustration of the cravings in the animals was, of course, purely externally determined, but the experiment proves that under high specific psychic tension the stomach behaves quite differently than in its more usual function.

If not conclusive, it is at least presumptive that similar somatic processes including local vascular and muscular changes—in other words, functional disturbances of the stomach effected by means of the autonomic nervous system—may be originated in men by the typical emotional conflicts described, which, in general, are based upon special childhood experiences. If such disturbances lead sometimes into a peptic ulcer, it would be only logical to recognize, next to the neurogenic, a psychogenic *ulcus pepticum*.

The value of these considerations for the practical physician is still a complicated matter. Since the care of the ulcer patient remains his privilege, in certain cases it would be of use to him to keep in mind that special nursing as dictated by the Sippy cure or the continuous milk drip into the stomach throughout the day and night [Winkelstein (37)], affects not only the acidity but the unconscious as well. Also, evaluating a low nocturnal acid curve in a patient with a gastric neurosis, [Winkelstein (38)], the emotional consequences of hospitalization should be taken into consideration; occasional hypersecretion in quite different psychic conditions is of course not excluded.

Individuals with peptic ulcers, however, are not psychiatric patients, and those who should see the psychiatrist many times never get to him. The psychiatrist, on his part, if he considers with Alexander some ulcers as the organic, final result of a psychogenic functional disturbance, certainly will prefer to be called earlier rather than

later when less reversible tissue changes have already developed. The present situation is still inadequate in many respects. Psychotherapeutic generalities offering the patient a better mental hygiene (less work, more rest, etc.) are of little permanent value for anyone who suffers from a deep-seated personality conflict which has led finally to such organic changes as peptic ulcer. On the other hand, far-reaching interpretations by a psychiatrically-minded physician, although correct, are just as unsatisfactory if administered without adequate preparation. With all this, of course, it is not maintained that every ulcer patient needs a psychoanalysis, but rather that those cases in which the psychogenic factor appears to be important require an expert psychotherapeutic handling just like any other psychoneurosis.

#### SUMMARY

A report was given on the history of two male patients who had suffered from peptic ulcer. Psychoanalysis, in both cases, enabled a more detailed observation of the relation between certain conflicting (oral) needs and the gastric disorder. An oral regression, following earlier female identification, and a sudden renunciation of aggressive tendencies were found to have been of definite importance for the development.

The most recent literature dealing with psychogenic factors in peptic ulcer was reviewed and, in accordance with some physiologic and psychoanalytic observations, special consideration was given to gastroduodenal ulcer as the final result of psychogenic functional gastric disturbances, effected by means of the autonomic nervous system and dependent on specific emotional conflicts, the basis for which is laid in childhood.

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## THE ELECTROMYOGRAM OF HANDWRITING

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IT IS A COMMON experience that the individuality of people or animals can be distinguished through characteristic patterns of muscular activity. Many attempts have been made to study these characteristic patterns of movement by means of photographs, moving pictures in conjunction with anatomical and physiological studies (13). Our personal interest in the problem of individual differences in motor behavior has led us to a study of electromyographic tracings obtained during handwriting, which is one of the most characteristic types of motor activity.

The inspection of electromyographic tracings obtained from subjects during continuous muscular activity shows various types of patterns for different individuals. In order to facilitate the use and the interpretation of this type of record and to obtain a sound basis for comparisons and correlations it seemed desirable to devise a method to classify these patterns in some reproducible quantitative manner. It is clear that such a method would give values which could be used to compare different sections of a given tracing as well as sections from tracings of different individuals during the same or during differing types of continuous muscular activity. The present paper presents a technique of this sort applied to tracings obtained during handwriting.

Sanderson (10) was one of the earliest investigators to concern himself with

the electrical reaction of muscle. Buchanan (2) studied the rhythmicity of electromyograms, while Piper (8) was more interested in the electrical responses obtained during voluntary contraction. More recently numerous papers (1, 6, 11) have appeared on the interpretation of human electromyograms. This problem has been greatly clarified by the introduction of a technique for recording action potentials of single motor units by Adrian and Bronk (1). Their records were obtained by the use of oscillographs for recording impulses mediated from coaxial needle electrodes in the muscle. Adrian (1), Smith (11) and Lindsley (6) studied the characteristic responses of motor units in normal humans and in patients (7). Their conclusions which bear upon the present problem are summarized. No electrical activity could be demonstrated in relaxed muscles. Different muscles showed no characteristic difference in electrical response. A maintained voluntary contraction showed a uniform amplitude characteristic of the movement and a fairly regular rhythm of 10 to 30 per second, the range of frequency for all muscular activity being from 3 to 50 per second. Increased strength of muscular movement was indicated by an increased frequency in action potentials of the motor units, brought about by the gradual accession of additional motor units. The onset of fatigue was characterized by a diminished amplitude at a constant frequency (3). That the amplitude itself is a function of the action potential and the

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distance of the electrodes from the contracting fibers was shown by Forbes and Barbeau (5). The results of these most recent studies seem to indicate that all waves are of the same origin and thus settled the problem as to the origin of the small and large waves and as to the range of frequency. In an analysis of the different types of waves observed Rijlant (9) distinguished between fast waves of high action potentials, corresponding to contraction and the much slower waves corresponding to tonic activity. To our knowledge no one has investigated the individual differences in amplitude and frequency observed in different individuals.

#### TECHNIQUE

Surface electrodes were used in this study for obtaining the action potentials from the muscles. The electrodes consisted of the usual flat solder discs, 6-10 mm. in diameter used in electroencephalographic work (after Gibbs) attached to an insulated wire. The active points of the skin above the muscle groups to be studied were cleaned with acetone and covered with Sanborn cardiographic paste. The electrodes were held in place by a film of collodion and by adhesive tape. Two such electrodes over each muscle constituted a bipolar lead which ran into a Grass electroencephalographic set of amplifiers (built in 1937). In most of the records four skin points were used and in some cases leads were taken from six.

The recording unit was a three channel ink writing oscillograph (Grass 1939) capable of following frequencies up to 120 cycles per second and having a paper speed of 6 cm. per second. No high pass muscle filters were in any of the circuits. Usually only two of the three available channels were used (one for the extensors and one for the flexors). In some instances a 10,000 ohm resistor was attached to the remaining

channel to act as a control to pick up 60 cycle or other aerial artifacts if present. In others this channel was not turned on. The active muscles used for study<sup>1</sup> are indicated in each of the figures below.

We wished to measure the comparative heights of the different action potentials obtained during handwriting. In this paper we are not concerned at all with the actual E.M.F. as expressed in microvolts of these potentials, a study of which will appear in a later communication. After several trials it was found that the optimal amplification was one that produced a 15 to 20 mm. diphasic spike on the record from the greatest muscle potentials in the particular group under observation at that time. With such a degree of amplification the smallest spikes could easily be seen and counted and could be accurately measured (1-3 mm.). Thus each observation and each different muscle group required a separate amplification adjustment in order to fit into this plan. On each head amplifier there was a simple 10 step coarse attenuator switch and on each power amplifier a finer adjustable sliding contact potentiometer type attenuator dial. Both sides of the push-pull circuit were simultaneously controlled by these switches so that rapid, exact changes in the amplification were simple to make. Amplification values are indicated by noting the setting of the 10 step switch, i.e., 0-1-2-3-4 etc., and multiplying it by the potentiometer setting 0-100. For example, 0x95, 1x75, etc. (see figures).

<sup>1</sup> In the usual type of handwriting the intrinsic muscles of the hand plus the flexors of the fingers hold the pencil or pen and the actual movements producing the writing are largely caused by movements induced by the flexors and extensors of the wrist. It was for this reason that the latter group of muscles are used in this study. It is to be noted however that some individuals utilize other muscles of the hand or biceps and triceps and even muscles in the shoulder. Handwriting is not only flexion and extension of the wrist.

The subjects were comfortably seated in an arm chair and the right arm was supported on a flat board attached to the chair arm. A fountain pen was held in the right hand on a thick sheet of stiff writing paper which had previously been placed on a desk adjacent to the arm chair. After being attached to the electrodes the subjects were asked to read a short standardized story presented on a card. They were then told to write the story. Each subject wrote several lines. During the experiment the investigator stood by watching the performance and noting by means of a stop watch the time used in writing each line. Several of the subjects were asked to attempt foot-writing. A pen was placed between the great and the second toe of the right foot and the subjects were asked to write the story in air, the electrodes being fastened on the tibialis anticus and gastrocnemius muscles.

Subjects consisted of 15 right handed individuals, none of whom had difficulty with their handwriting. Ten of these individuals (6 males and 4 females) were normal subjects. As a group they consisted of doctors, technicians and secretaries. Of the five patients (3 males and 2 females) two were diagnosed torticollis and the other three were diagnosed arthritis, psychoneurosis and multiple sclerosis.

#### DATA

The analysis of the myogram tracings was made from the records obtained from the 15 subjects while writing. Samples of the myogram tracings of each subject are presented in Fig. 1. The analysis of these samples is given in Tables 1, 3 and 4. The handwritings and a sample of the myogram record of the hand and foot writing of three subjects (Nos. 1, 5, and 14) are presented in Figs. 2, 3 and 4. Samples of continuous myogram records of four

subjects (Nos. 1, 2, 10, and 11) obtained during the same sitting are presented in Figs. 7 and 8, and analyzed in Tables 5, 6, 7 and 8. Several subjects repeated the experiment on the same and on different days. The analyses of these records are presented below in Tables 9-10.

#### ANALYSIS OF MYOGRAMS

Sections of the electromyogram tracings for the handwriting of the 15 subjects are shown in Fig. 1. Simultaneous tracings of the extensor and flexor groups of muscles can be seen in each section and in addition in 2 subjects (Nos. 1 and 2) there are tracings from the thenar muscles (thumb). In each section time is indicated in seconds and there is also seen a line traced by a control pen which is used to indicate artifacts that may arise from the apparatus itself or from extraneous sources. The absence of excursions of the control pen (straight line) contrasts with the continuous up and down tracings obtained from the extensor and flexor groups. These continuous oscillations, referred to as spikes in the tracings, indicate the presence of continuous muscular activity, with no intermittent periods of complete relaxation. This type of myogram differs from one obtained upon discrete interrupted muscular movements in which the tracings show periods of absolute inactivity interposed between each movement. Since in the act of handwriting the actual writing of letters and words on paper is discontinuous, it follows that the continuous muscular activity seen from these tracings must be associated with the contraction of the muscles involved in holding the pen as well as with the contractions involved in moving the pen on the paper.

The spikes differ in height and these variations produce different patterns which are apparent from gross observa-

## EMG TRACING OF HANDWRITING

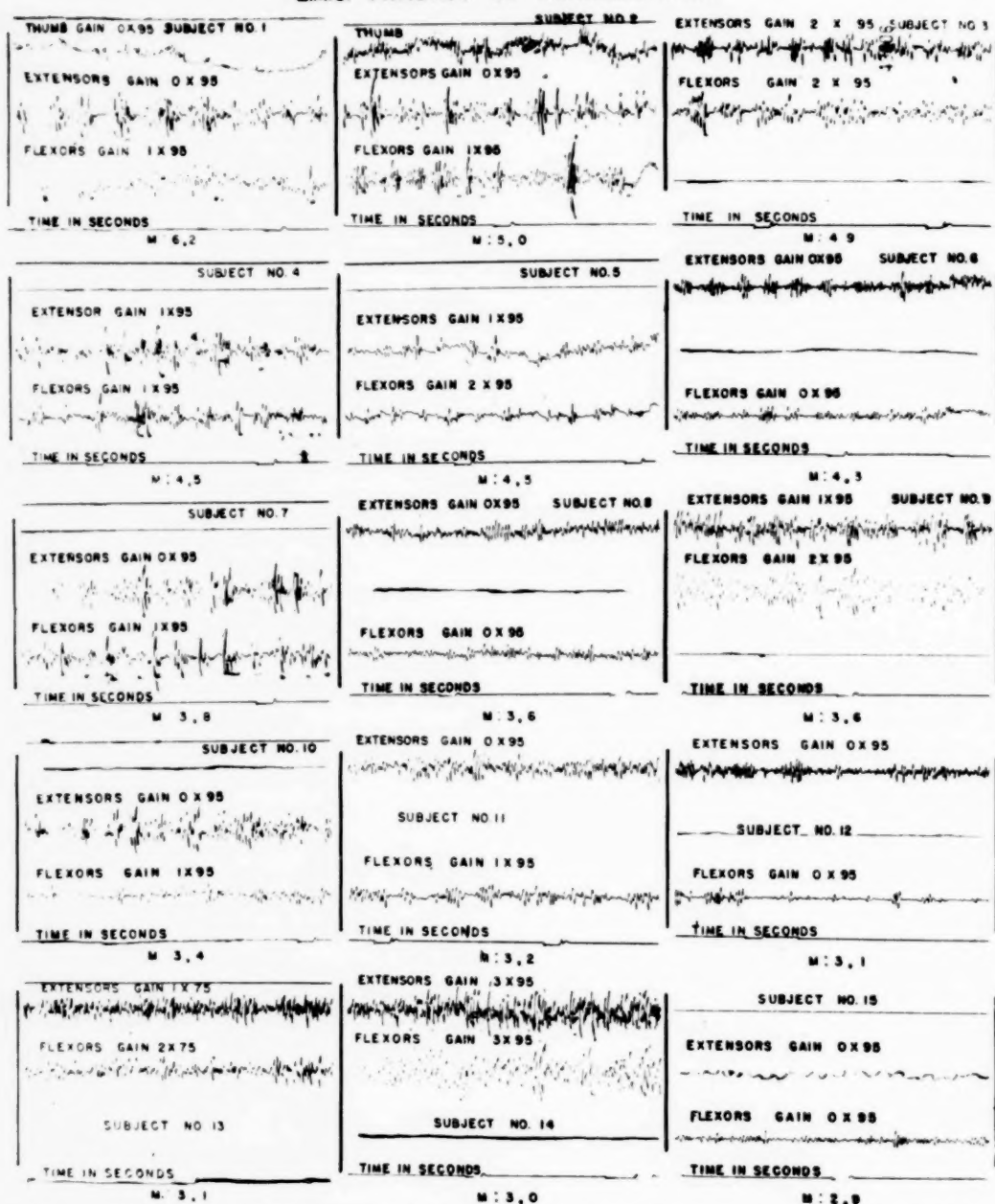


FIG. 1. Short samples of electromyographic tracings of the handwriting of 15 subjects. The tracings of the extensor muscles are arranged according to descending values of  $M$ , which is the ratio of the sum of the maxima over the sum of the minima. The 3 samples in the first row (subjects 1, 2 and 3) show distinct group patterns of type I with high  $M$  values (Fig. 2). The 3 tracings on the fifth row (subjects 13, 14 and 15) demonstrate an irregular pattern of type III with low  $M$  values (Fig. 4). The tracings on the third row (subjects 7, 8 and 9) show spindle patterns of type II with medium  $M$  values (Fig. 3). The analysis of these sections is presented in Table 15.

tion. In many of the tracings large and small spikes appear to follow a random sequence, whereas in some of the tracings groups of high spikes can be seen separated by one or more smaller spikes. In the present study attention is focused on the tracings from the extensor muscles.

In order to obtain objective criteria for studying these tracings, measurements were made of the frequency of the spikes and of the height of the in-

TABLE 1  
FREQUENCY OF SPIKES IN MYOGRAM TRACINGS  
OF HANDWRITING

Number of Subject	Spikes per Second
1	59
2	55
3	60
4	60
5	56
6	60
7	57
8	55
9	60
10	55
11	58
12	61
13	53
14	54
15	59

Mean Value = 57.5  
Variation = 57 ( $\pm 4$ )  
57 ( $\pm 7\%$ )

dividual spikes. A definition was then selected upon which the grouping of the spikes could be based and each curve was accordingly divided into its component groups. The groups were then classified according to length, height and symmetry.

*Frequency.* It has been referred to under technique that the frequency of the spikes is effected by the gain of amplification used. As the gain is increased from low values there is an increase in the frequency up to a point (referred to as the optimal gain) beyond which further increase in gain does not cause additional increase in frequency. The optimal gain, which was used for each record, varies from individual to

individual (See Fig. 1). The frequency in spikes per second was measured from a 2 second period of the handwriting records for the 15 subjects. These values appear in Table 1. The mean for these subjects was 57.5 spikes per second, with a variation of  $\pm 7$  per cent. Since the variation from subject to subject was so small, frequency did not appear to be a variable characteristic of the individual myograms obtained in handwriting, and hence for the present study was considered to be a constant factor.

*Size of the Spikes.* The size of the spikes could be expressed in terms of amplitude (up or down excursion from a zero line) or in terms of the whole length of the excursion (diphasic action potential). For the sake of greater accuracy in measurement the second procedure was followed, measurement being made of the vertical distance between the extreme ends of each up stroke. This measurement was made in millimeters, estimates being carried to within 0.1 mm. with the aid of a large magnifying lens mounted over a ruler on a sliding carriage. A ratchet mechanism enabled one to move the carriage along the record from spike to spike. When the size of the spikes approached the width of the ink line (values of less than 1 mm.) some inaccuracy due to artifacts was to be expected, and it seemed not worth while to distinguish the gradations within this range. Hence values of 0.1 to 0.5 mm. were considered as 0.5 mm. and values of 0.6 to 1.0 mm. were considered as 1.0 mm. The spikes ranged from these low limits up to a maximum of about 25 mm.

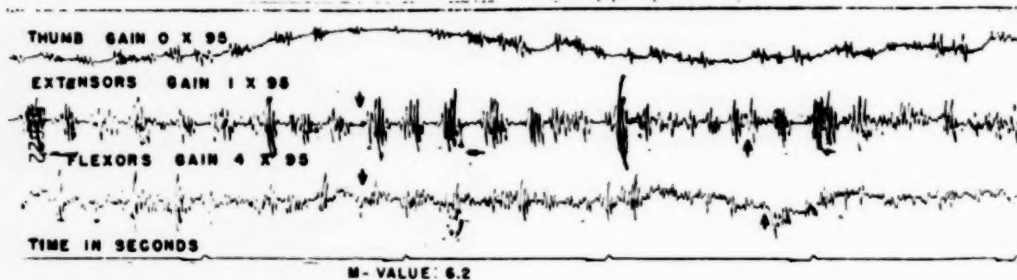
In view of the different amplification used in the individual cases to secure maximum frequency, the tracings could not be compared with each other on the basis of the absolute size of the spikes. This difficulty was surmounted by the selection of certain ratios derived from

## SUBJECT NO. 1

## HANDWRITING SPECIMEN

*A dam which carried salt, had to cross a river.  
As he was doing so, he fell down, and remained  
lying comfortably in the cool water*

## E.M.G. TRACING OF HANDWRITING



## SCHEMATIZED E.M.G. TYPE I. - PATTERN OF ISOLATED GROUPS



## E.M.G. TRACING OF FOOT WRITING

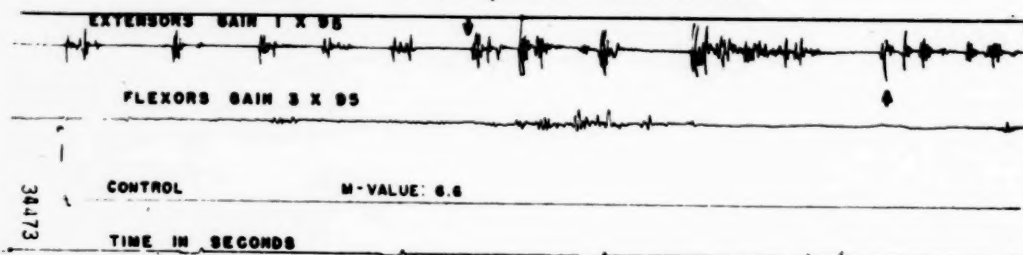


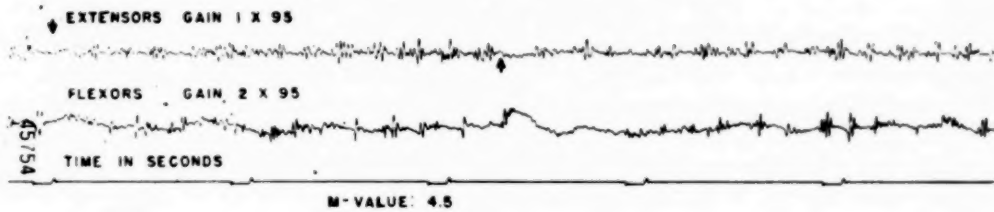
FIG. 2. Handwriting specimens of subject 1 written during a 25 second period. The E.M.G. tracing represents a section obtained during a 5 second period of the above handwriting. The section between the arrows is approximately a two second period and contains 120 spikes, the measurement of which is arranged in Table 2. The E.M.G. tracing ( $M = 6.2$ ) shows definite groups of the long and high type (Tables 3 and 5), a schematization of which is given below the tracing. The E.M.G. of foot writing also shows a similar pattern interrupted by periods of relative inactivity.

## SUBJECT NO. 5

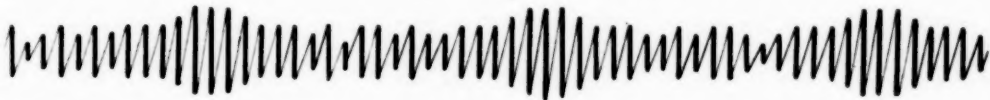
## HANDWRITING SPECIMEN

A fisherman who cannot swim had to cross a  
river. As he was doing so, he fell down and  
remained lying comfortably in the cold water.

## E.M.G. TRACING OF HANDWRITING



## SCHEMATIZED E.M.G. OF TYPE II. — SPINDLE PATTERN



## E.M.G. TRACING OF FOOT WRITING

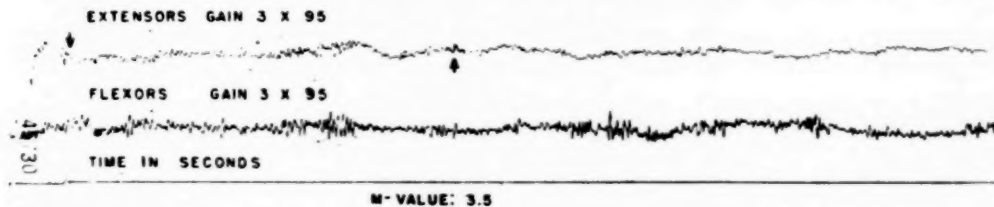


FIG. 3. Handwriting specimen of subject 5 written during a period of approximately 30 seconds. The section of the extensor tracing of handwriting between the two arrows ( $M=4.5$ ) illustrates medium and low groups resembling a spindle pattern, which is schematized as type II. The same type of pattern is seen in the tracing of foot writing.

these sizes to be used as indices. These indices will be discussed below.

*Configuration of the Myograms.* A cursory examination of the 15 extensor tracings of Fig. 1 shows a series of individual patterns. In some of these tracings (Subjects 1, 2, 3, 4, 5, 6, and 7) the eye detects definite grouping of the spikes, which is not so apparent in the other records. In numbers 13 and 14, for example, the arrangement of long and short spikes seems to be quite chaotic and no regular groups appear to the eye. Of those with recognizable groups, some appear to have predominately high isolated groups interspersed with periods of relative inactivity characterized by very short spikes. An example of this appears in Fig. 2 which includes a specimen of the handwriting of subject 1 and its electromyogram tracing. A schematization of this pattern is given. A tracing obtained from the same subject during attempts at foot writing shows a somewhat similar grouping. Another type of group which is apparent in the records is a long, flat group which can be referred to as a spindle. An example of this grouping together with a schematization appears in Fig. 3. The handwriting of this subject (No. 5) is also given, and a sample of the foot writing. The irregular pattern is exemplified in Fig. 4, in which the absence of small definite groups is striking.

It seemed desirable to establish a more objective criterion for the detection and evaluation of the groups, based upon actual measurement of the individual spikes. The following definition was selected. A series of spikes the sizes of which progressively increased up to a maximum and then decreased to a minimum low value, was considered as a group. By definition the maximum spike must be larger than the minimum spike by more than one-half the size of

the minimum (maximum greater than  $3/2$  minimum). The same relation must apply between the maximum and the minimum preceding it. Whenever the difference between the largest and smallest spike of a progressive series is less than that defined in the formula, the large and small spikes are not referred to as maximum and minimum, and the series of spikes in question is classed not as a separable group, but as a part of a larger group. By this definition some small changes in phase in the tracings are overlooked. On the other hand the entire tracing is thereby subject to group analysis, and this analysis yields many more groups than were apparent to the eye. When the tracings were analyzed in this way, the following types of groups appeared.

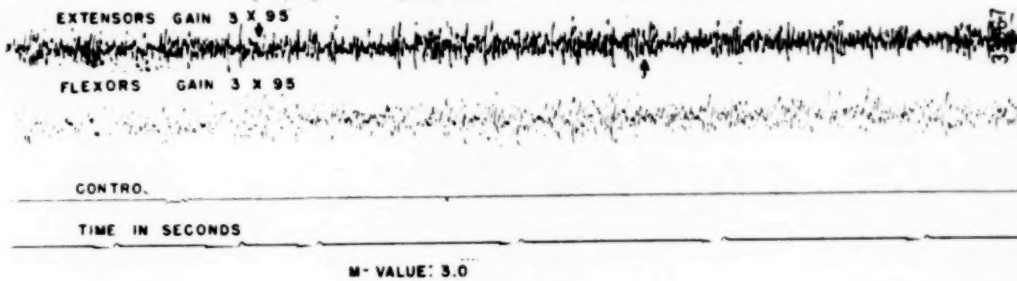
1) Long groups. In these groups the rise from minimum to maximum and the subsequent fall to a second minimum each involved at least 4 spikes, making at least 7 spikes for the entire group. These long groups were classified as high, medium and low depending on whether the ratio of maximum to minimum spike was greater than 10, less than 10 but greater than 5, or less than 5 respectively. They were further subdivided as symmetrical or asymmetrical depending on whether or not the ratios of maximum to minimum were comparable for both sides of the group. Thus, for example, a long group consisting of 9 spikes would be high and symmetrical if the first and second minimum were 1 mm. long, and the maximum were 10 mm. long; it would be high but asymmetrical if the first minimum were again 1 mm., the maximum again 10 mm. and the second minimum were 2 mm. The group would be of medium height but symmetrical if the minima were both 2 mm. and the maximum again 10 mm.; it would be of medium height but asymmetrical if the

## SUBJECT NO. 14

## HANDWRITING SPECIMEN

*A doctor who cannot salt had to cross a river. As he  
was doing so he fell down and remained lying comfortably  
in the cool water for a few moments.*

## E.M.G. TRACING OF HANDWRITING



## SCHEMATIZED E.M.G. OF TYPE III.—IRREGULAR PATTERN



## E.M.G. TRACING OF FOOT WRITING

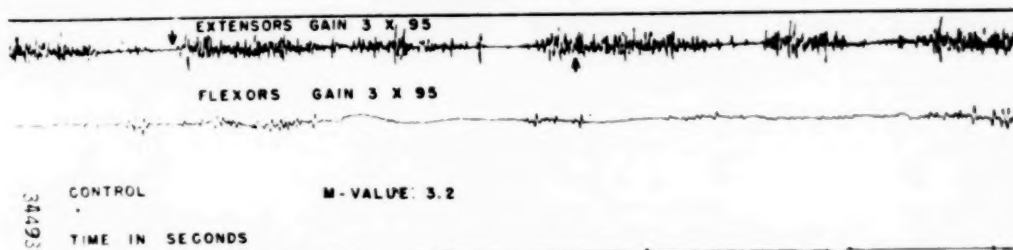


FIG. 4. Handwriting specimen of subject 14 written during a period of approximately 35 seconds. The section of the corresponding extensor tracing between the two arrows ( $M=3.0$ ) illustrates the irregular pattern schematized as type III. The same pattern can be seen in the tracings of foot writing. The pattern for the foot writing is interrupted by periods of relative inactivity.

first minimum were 2 mm., the maximum 10 mm. and the second minimum were 5 mm.

2) Short groups. In these groups the rise from minimum to maximum and the subsequent fall to a second minimum involved in each case either 2 or 3 spikes, making possible a total length of from 3 to 5 spikes for the whole group. Again these groups were classified as high, medium or low, and as symmetrical or asymmetrical, according to the same criteria as those described for the long groups.

to distinguish between tracings which involve predominantly long, short or mixed groups, and to characterize these groups in terms describing the ascending and descending slopes.

4) Indices. In order to simplify the comparison of the curves, indices were derived which are in some measure related to the group characteristics described above. The first index, G, represents the number of groups in the section. The second index, M, was defined as the sum of all the maxima in a series of 120 spikes, divided by the sum

TABLE 2  
SIZE OF CONSECUTIVE INDIVIDUAL SPIKES IN MILLIMETERS

Column	1	2	3	4	5	6	7	8	9	10
	(1.9)	10.0	3.7	1.9	1.7	(4.5)	3.4	(2.2)	4.2	5.0
	2.0	11.0	11.0	5.0	6.0	7.0	(1.0)	5.0	2.1	3.0
	4.1	9.0	13.0	10.0	10.5	2.9	4.2	11.0	2.2	(1.0)
	9.5	16.0	12.0	11.0	10.0	(2.9)	(2.0)	6.0	(1.0)	1.0
	11.0	5.0	17.0	15.0	(2.8)	6.0	7.0	(1.0)	6.0	2.5
	18.0	4.1	5.5	12.0	9.0	4.7	22.0	4.3	6.0	11.0
	11.0	(0.5)	7.0	7.0	7.5	(2.7)	12.0	4.0	2.8	10.0
	7.0	1.0	1.2	(2.9)	(1.1)	8.0	(1.1)	1.8	(1.0)	7.0
	2.5	1.0	1.7	7.0	2.0	4.8	2.0	(1.0)	2.0	4.1
	(1.3)	(0.5)	1.2	1.5	6.0	1.0	(1.3)	3.8	2.7	(1.3)
	1.8	1.2	(0.5)	(1.0)	11.0	(1.0)	2.1	2.8	7.5	10.0
	4.7	1.6	1.4	1.4	6.0	1.0	7.0	5.0	4.2	

The figures are to be read vertically from top to bottom starting from column 1 and progressing to the right. The maxima are italics and the minima are in parentheses.

3) Mixed groups. In these groups one side of the slope was long (involved 4 or more spikes) and the other side was short (less than 4 spikes). These groups were also subdivided according to the same criteria as those described for the long groups.

The length of the spikes for a section of the handwriting tracing on subject 1 including 120 spikes (about 2 seconds) is presented in Table 2. The tracing of this section can be seen in Fig. 2. The maxima are in italics and the minima are given in parentheses. This section gives illustrations of almost all of the groups described above. The ratio of maximum to minimum varied from 1.5 to 34.

This method of analysis enables one

of the minima. If the number of maxima is one more than the number of minima or *vice versa* one of the maxima is dropped from this calculation. This ratio, while numerically not equivalent to the mean of all of the maximum to minimum ratios in the given section of the record, should obviously increase with the number of high groups in the section. The significance of M will become clarified later.

The second index, B, is defined as the ratio of the 20 largest spikes over the 20 smallest spikes. These large and small spikes may or may not all coincide with the maxima and the minima. This index is independent of the number of groups in the section.

In addition to these 3 indices, two

more characteristics of the curves were determined, namely the number of sequences of 2 or more spikes equal to or greater than 10 mm. in length (sequence of large spikes), and the number of sequences of 3 or more spikes of 2 mm. or less in length (sequence of small spikes). The sequences of large spikes would indicate the presence of periods of intensive activity, and the sequences of small spikes would indicate the presence of period of relative inactivity.

These indices are applied below to the data in Table 2.

Number of groups = 24

Sum of the maxima (numbers in italics) = 218.7

Sum of the minima (numbers in parentheses) = 35.5

Sum of 20 largest spikes = 267.5

Sum of 20 smallest spikes = 17.0.

If the figures are substituted in the formulae:

$$G = \text{number of group} = 24$$

$$M = \frac{\text{sum of maxima}}{\text{sum of minima}} = \frac{218.7}{35.7} = 6.2$$

$$B = \frac{20 \text{ largest spikes}}{20 \text{ smallest spikes}} = \frac{267.5}{17} = 15.7$$

The analysis of this section appears as the data for subject 1, Table 3. All the other sections were similarly analyzed and tabulated.

The electromyogram tracings on 15 subjects shown in Fig. 1 were subjected to analysis and the results are summarized in Table 3. The sections analyzed consisted in each case of 120 spikes and represented about 2 seconds of writing. The values of G, M, and B

TABLE 3  
ANALYSIS OF TRACINGS OF 15 SUBJECTS

No. of Subject	G	M	B	Classification of Groups										Small Spikes
				Long			Mixed			Short				
				Total	High	Low	Total	High	Low	Total	High	Low		
1	23	6.2	15.7	7	5(2)	—	5	3(1)	1	11	1(—)	6	5	
2	33	5.0	14.9	2	1(1)	—	10	6(2)	1	21	4(—)	7	3	
3	21	4.9	9.9	4	2(1)	—	11	1(1)	2	6	1(—)	3	4	
4	25	4.5	8.2	3	1(1)	—	10	1(—)	3	12	—	8	7	
5	24	4.5	7.6	4	—	1	8	—	2	12	2(1)	5	11	
6	17	4.3	5.7	6	3(2)	2	8	—	4	3	—	3	11	
7	25	3.8	6.6	5	3(—)	—	8	2(—)	3	12	—	10	—	
8	31	3.6	5.5	—	—	—	14	1(—)	7	17	2(—)	11	1	
9	19	3.6	3.8	4	—	3	13	—	12	2	—	2	10	
10	24	3.4	7.0	4	1(1)	2	10	3(—)	3	10	—	8	1	
11	27	3.2	5.7	4	—	2	9	1(—)	3	14	—	9	—	
12	19	3.1	3.8	6	—	3	8	—	6	5	—	5	12	
13	23	3.1	6.1	4	2(1)	2	11	2(—)	5	8	—	4	8	
14	31	3.0	5.5	4	—	2	8	1	6	19	1	14	1	
15	26	2.9	5.5	3	2(—)	—	12	—	8	11	—	11	1	
Total.....	368	59.1	111.6	60	20(9)	17	145	21(5)	66	163	11(1)	106	75	
Mean.....	24.5	3.9	7.4	40	1.4	1.1	9.7	1.4	4.4	10.9	.7	7.1	3.0	
% of all groups (G)	100%			16	5	5	40	6	18	44	3	29		

Long groups are those in which number of spikes from minimum to maximum on both sides of maximum is greater than 3.

Mixed groups are those in which number of spikes from minimum to maximum is less than 3 on one side and greater than 3 on the other side.

Short groups are those in which the number of spikes from minimum to maximum on both sides of maximum is less than 3.

High groups are those in which ratio of maximum to minimum is greater than 10. The number in parentheses refers to high groups symmetrical with respect to the two minima.

Small spikes refer to number of sequences of three or more spikes less than 2 mm.

were calculated, and the groups were classified in terms of their length, height and symmetry. Also the presence or absence of prolonged periods of relative relaxation between the maxima was examined by studying the sequences of 3 or more small spikes (2 mm. or less in size) between maxima, and the presence of periods of intensive activity was similarly examined by noting the number of sequences of 3 or more large spikes (10 mm. or over) occurring in the records.

It will be seen that the number of groups varied between 17 and 33, with

scribed in Table 3 the following table was constructed. The series of 15 patients, which had been previously arranged in descending values of M (Table 3) was grouped so as to form 3 classes of 5 subjects each. Class I, II, and III include subjects 1 to 5, 6 to 10, 11 to 15 respectively. The individual values for each subject in the group were added and an average value obtained for the classes (see Table 4).

1) *Correlation between M and height of groups.* Individuals in Class I (high M values) show a greater number of high groups than do individuals in Class

TABLE 4  
SUMMARY OF MEAN VALUES OF TABLE 3  
HIGH M (CLASS I), MEDIUM M (CLASS II), AND LOW M (CLASS III)

Class	Subjects	G	M	B	Classification of Groups						Sequence of Small Spikes
					Long		Mixed		Short		
					High	Low	High	Low	High	Low	
I	1-5	25.2	5.0	11.3	1.8	0.2	2.2	1.8	1.6	5.8	6
II	6-10	23.2	3.7	5.7	1.4	1.4	1.2	5.8	0.4	6.8	4.8
III	11-15	25.2	3.1	5.3	0.8	1.8	0.8	5.6	0.2	8.6	4.5

a mean value for all the subjects of 24.5. The value of M ranged from 6.2 for subject 1 to 2.7 for subject 15, and thus varied from the mean of 3.9 by +59 and -26 per cent. Similarly B varied from a maximum of 15.7 again for subject 1, to 3.8 for subjects 9 and 12, and these values represent departures of respectively +112 and -49 per cent from the mean of 7.4. The numbers of groups under the different categories of long, mixed and short varied in a manner that seemed to be related to the number of groups, G. Thus the subjects having the largest number of groups (subjects 6, 9 and 12) are the only subjects with more long groups than short groups.

*Correlation Between Indices and Length and Height of Group.* In an attempt to study the relationship between G, M and B and the types of groups as de-

III (low M values). This holds true regardless of the size of the groups (long, mixed or short). On the other hand subjects in Class III (low M values) have more low groups than subjects in Class I (high M values). This relationship is again independent of the size of the groups. The ratio of high to low groups for Class I is 9 to 1 for the long groups, and only 1 to  $3\frac{1}{2}$  for the short groups. For Class III the ratio of high to low is about 1 to 2 for the long groups and about 1 to 40 for the short groups. In other words, the long groups are characteristically high for Class I subjects, and the short groups are characteristically low for Class II, as well as for Class III subjects. These relationships apply to the mean values and do not of necessity apply to any single subject. A similar relationship is not found on comparing

G with the height of the groups. Individuals in Class I show a greater mean value for the number of successive small spikes than do individuals in Class III. No relation was found to obtain between B and M on the one hand and the number of successive large spikes on the other hand.

2) *Correlation between G and length of groups.* The relation between the G value and the number of spikes forming a group is shown in distribution curve Fig. 5. The 15 subjects were classified into three categories whose G values ranged from 18 to 24 (5 subjects), 25 to 29 (7 subjects) and 30 to 34 (3 subjects). The number of spikes forming a group was plotted as abscissae and the frequency of any group length expressed in per cent of the total number of groups was plotted as ordinates. It can be seen that the individuals whose G value was low had a relatively smaller per cent of short groups (2-3 spikes) than did individuals whose G value was high. Conversely, individuals with a high G value (30-34) had a greater number of small groups. Individuals with low G values had a greater num-

ber of long groups (10-11 spikes) than did individuals with a higher G value. Fig. 5 illustrates the reciprocal relation between the size of groups and the total number of groups in a 2 second section of electromyogram tracing.

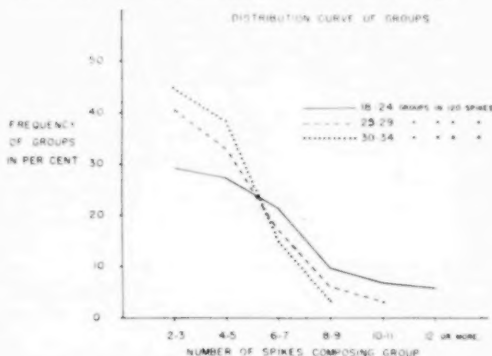


FIG. 6. Distribution curves for the size of spikes of 15 subjects (Fig. 1, Table 3). The spikes are plotted on the abscissa in 6 arbitrary groups, which are formed by increasing increments of  $\frac{1}{6}$  of the highest spike for each tracing analyzed. The frequency in per cent of the total number of spikes is plotted along the ordinate. Three distribution curves are presented for subjects having low, medium and high M values. Subjects with high M values have the greatest number of small spikes whereas subjects with low M values show a small number of small spikes.

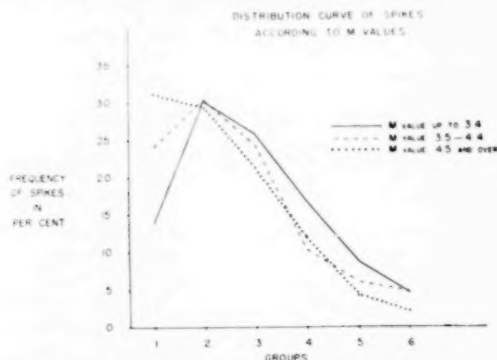


FIG. 5. Distribution curves of the groups of 15 subjects (Fig. 1, Table 3). The groups are plotted along the abscissa arranged as to length in terms of the number of spikes forming each group. The incidence in per cent frequency is plotted along the ordinate. Three distribution curves are presented for subjects having a low number of groups (18-24), for subjects having a moderate number of groups (25-29) and for subjects having a large number of groups (30-34). There is a reciprocal relationship between the size of the groups and the per cent frequency.

3) *Correlation between M and the height of the spikes.* In order to compare the relative height of the spikes for different individuals it was necessary, on account of the different gains in amplification, to use relative values. For this purpose the largest spike in each 2 second record was selected and measured. The measurement was divided by six, and six different categories were arranged with increasing values of  $\frac{1}{6}$  of the largest spike. All of the spikes of a given record were then distributed into these six categories. The same procedure was done for each of the 15 subjects. The size of the spikes arranged in these 6 arbitrary categories was plotted as abscissae and the frequency in terms of per cent of all the spikes was plotted as ordinates. The subjects were arranged in three classes of 5 subjects each, whose M values ranged from 2.9

to 3.4 (low M), from 3.5 to 4.4 (medium M), and from 4.5 and over (high M). A distribution curve was plotted for each class of M. Fig. 6 indicates that subjects with high M values have the greatest per cent of short spikes (Group I) whereas subjects with a low M value (3.4 and below) have the greatest number of spikes that fall within Group II

sence of periods of relative relaxation between the maxima was examined by studying the arrangement of the small spikes (2 mm. or less) between maxima. The tracings comprising samples 1-6 are shown in Fig. 5 and Fig. 6.

From Table 5 it may be seen that the number of groups in each sample varies from 19 to 24 (variation +8 to -15 per

TABLE 5  
ANALYSIS OF TEN CONSECUTIVE SECTIONS OF SUBJECT NO. 1

Sample	G	M	B	Classification of Groups									Small Spikes
				Long			Mixed			Short			
				Total	High	Low	Total	High	Low	Total	High	Low	
1	24	4.4	8.7	5	5(2)	—	9	5(1)	—	10	—	5	—
2	23	3.6	7.3	3	—	2	15	2(1)	6	5	—	3	—
3	20	3.8	8.1	4	3(—)	—	13	6(—)	3	3	—	3	2
4	23	3.4	8.0	4	1(—)	1	8	—	2	11	—	5	4
5	22	4.3	8.8	5	2(2)	—	10	4(—)	3	7	—	5	3
6	23	3.9	10.2	2	1(—)	—	13	1(—)	3	8	1(—)	—	6
7	19	3.6	8.5	6	2(—)	1	11	1(—)	4	2	1(—)	1	4
8	23	3.8	8.9	4	3(1)	1	11	6(—)	1	8	1(—)	3	5
9	22	4.6	11.2	3	3(1)	—	10	4(—)	1	9	—	2	3
10	23	4.3	8.6	4	3(2)	1	11	2(1)	6	8	—	6	4
Total . . . .	222			40	23(8)	6	111	31(3)	29	71	3(—)	40	31
Mean . . . .	22.2	4.0	8.8	4.0			11.1			7.1			3.1
% of all groups (G)	100%			18%			50%			32%			

Long groups are those in which number of spikes from minimum to maximum on both sides of maximum is greater than 3.

Mixed groups are those in which number of spikes from minimum to maximum is less than 3 on one side and greater than 3 on the other side.

Short groups are those in which the number of spikes from minimum to maximum on both sides of maximum is less than 3.

High groups are those in which ratio of maximum to minimum is greater than 10. The numbers in parentheses refer to high groups symmetrical with respect to the two minima.

Small spikes refer to number of sequences of three or more spikes less than 2 mm.

(medium size). This distribution coincides with the fact (Table 4) that the greatest number of small spike sequences occur in Class I (Fig. 4) high M values.

#### CONSISTENCY

1) *Consecutive sections of a given record.* Ten consecutive sections of an electromyogram tracing on subject 1, consisting of 120 spikes each, were separately analyzed. For each section the values of G, M and B were determined, and are given in Table 5. The groups were classified in terms of their length and height. Also the presence or ab-

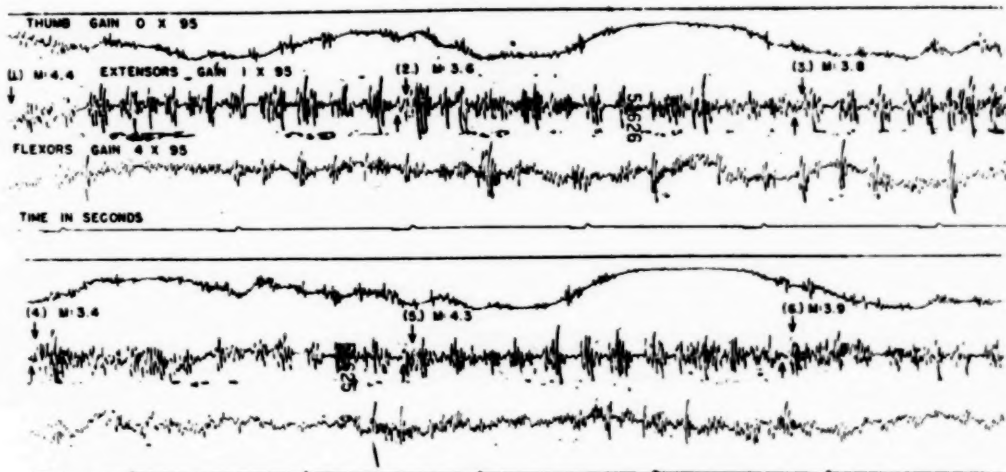
sence of periods of relative relaxation between the maxima was examined by studying the arrangement of the small spikes (2 mm. or less) between maxima. The tracings comprising samples 1-6 are shown in Fig. 5 and Fig. 6. From Table 5 it may be seen that the number of groups in each sample varies from 19 to 24 (variation +8 to -15 per cent). M varied from 3.4 to 4.6 ( $\pm 15$  per cent from the mean). B varied from 7.3 to 11.2 ( $+27$  to  $-17$  per cent of the mean). These variations in the separate sections are very much smaller than those appearing for the 15 different individuals in Table 3. The classification of the groups for all ten sections indicates that about  $\frac{1}{2}$  of them were mixed as to length, while  $\frac{1}{3}$  of the groups were short. Of the 40 long groups, more than  $\frac{1}{2}$  were high, but most of these were not symmetrically so, in other words the minimum on one side of the maximum was considerably lower than on the

other side. More than one quarter of the mixed sized groups were also high, but again mostly asymmetrical. More than  $\frac{1}{2}$  of the short groups and about one quarter of the mixed groups were low, but relatively few of the long groups were low. The distribution of the groups in the ten separate sections appeared to be fairly consistent with this general picture, high groups ap-

pearing in 9 out of 10 samples in the category of long groups and also in 9 out of 10 samples in the category of mixed groups. One or two low groups appeared in only 5 of the samples in the category of long groups, but between 1 and 7 low groups appeared in each case in the category of short groups. In the last column of Table 5 there appears a record of the number of times in the

## E.M.G. TRACING OF HANDWRITING

## SUBJECT NO. I



## SUBJECT NO. II

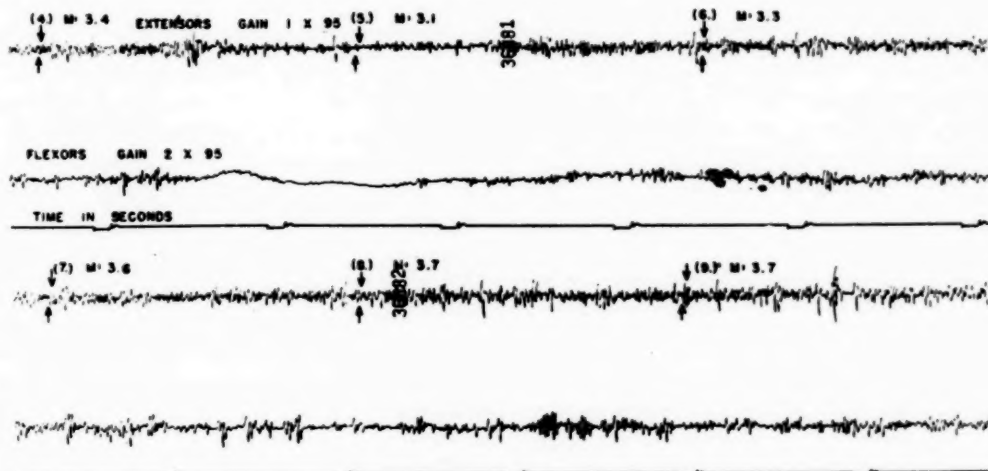


FIG. 7. Consecutive tracings for a period of 10 seconds of handwriting in subjects I and II.

given section of tracing a sequence of 3 or more small spikes (less than 2 mm.) occurred between maxima. In most of the samples periods of relative inactivity occurred between maxima.

In summary, the record is one showing consistently rather small numbers of groups and values of M and B which were rather high but not so great as the top values found in Table 3. There was

mean). The mean value of M, 6.5, was high. The values for the individual samples were also high, varying from -26 per cent to +37 per cent of the mean. The mean B value was high (12.8), the variation for the ten samples being from -16 per cent to +20 per cent. In six of the samples there occur six or more sequences of small spikes, indicating periods of relative relaxation.

TABLE 6  
ANALYSIS OF TEN CONSECUTIVE SECTIONS OF SUBJECT NO. 2

Sample	G	M	B	Classification of Groups									Small Spikes
				Long			Mixed			Short			
				Total	High	Low	Total	High	Low	Total	High	Low	
1	29	6.8	14.8	1	1(1)	—	9	5(2)	2	19	3(—)	7	3
2	27	4.8	11.5	1	—	—	14	5(1)	2	12	3(—)	8	1
3	31	5.7	12.9	1	1(—)	—	11	6(2)	1	19	4(—)	8	2
4	33	5.7	10.8	1	—	—	9	6(2)	—	23	5(1)	7	—
5	26	6.1	12.7	3	1(1)	—	13	6(2)	3	10	1(—)	4	7
6	28	7.1	15.3	2	1(—)	—	12	5(2)	2	14	—	8	9
7	31	6.5	12.8	3	3(1)	1	8	4(1)	1	20	9(2)	6	6
8	28	7.5	12.4	—	—	—	16	11(6)	2	12	2(1)	6	8
9	29	8.9	13.1	3	3(2)	—	7	3(3)	2	19	6(5)	9	8
10	33	6.3	11.4	1	1(—)	—	10	5(2)	2	22	6(2)	4	7
Total.....	295			16	11(5)	1	109	56(23)	17	170	39(11)	67	51
Mean.....	29.5	6.5	12.8	1.6			10.9			17.0			5.1
% of all groups (G)	100%			5%			37%			58%			

Long groups are those in which number of spikes from minimum to maximum on both sides of maximum is greater than 3.

Mixed groups are those in which number of spikes from minimum to maximum is less than 3 on one side and greater than 3 on the other side.

Short groups are those in which the number of spikes from minimum to maximum on both sides of maximum is less than 3.

High groups are those in which ratio of maximum to minimum is greater than 10. The numbers in parentheses refer to high groups symmetrical with respect to the two minima.

Small spikes refer to number of sequences of three or more spikes less than 2 mm.

a large number of high groups (one quarter of all the groups) which were distributed among the long and mixed groups, while about one-third of the groups were low, many of these being also short.

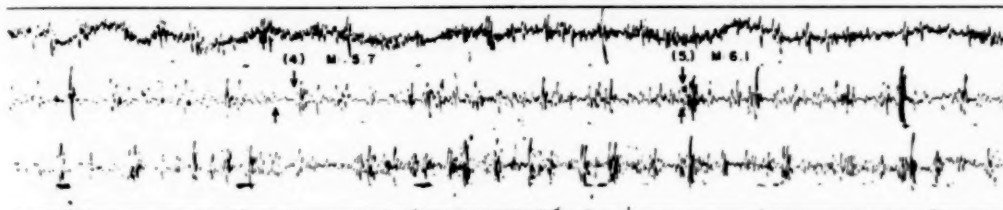
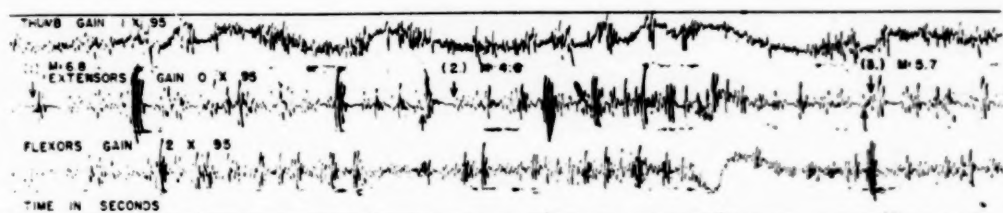
The consecutive tracings of an electromyogram on subject 2 are presented in Fig. 8 and the values for B, G and M and the classification of groups are presented in Table 6. This subject showed a large number of groups, which varied for the ten samples from 26 to 33 ( $\pm 12$  per cent variation from the

In summary, the consistent presence of a large number of groups (high G) is again associated with many short groups and very few long groups. At the same time the high value of M is associated with a large number of high groups, which in this case are distributed mainly between the mixed and the short groups. There occur a number of periods of relative relaxation.

The values for ten consecutive tracings for subject 10 (see Fig. 8) are presented in Table 7. In this subject the number of groups is high, and the M

## E.M.G. TRACING OF HANDWRITING

## SUBJECT NO. 2



## SUBJECT NO. 10

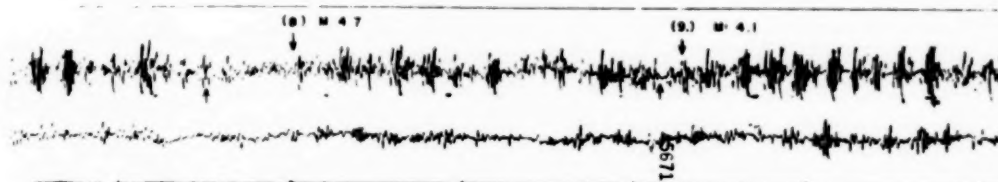
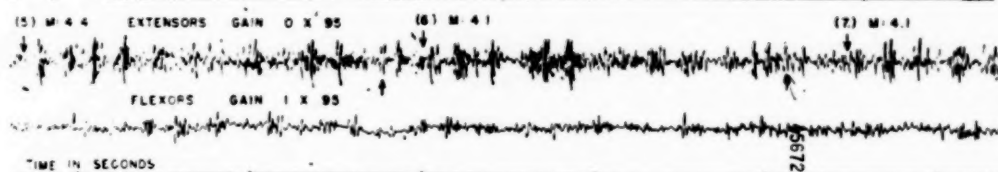


FIG. 8. Consecutive tracings for a period of 10 seconds of handwriting of subjects 2 and 10.

and B values are consistently in the middle range. The variation from the mean for G was +8 per cent and -13 per cent, for M +14 and -12 per cent and for B the values were +15 and -13 per cent. In this subject as in subject 2 over 50 per cent of the groups were short and of these about half were low. About one-third of the groups were of the mixed type and only 11 per cent were of the long type. More than half

of the long groups were classified as high. The high groups represent about 20 per cent of all of the groups, and were fairly consistently present in the long, mixed and short classifications. There were only few series of small spikes present. In summary this subject has many short groups and shows some tendency toward high group formation without intermittent periods of relative relaxation.

TABLE 7  
ANALYSIS OF TEN CONSECUTIVE SECTIONS OF SUBJECT NO. 10

Sample	G	M	B	Classification of Groups									Small Spikes
				Long			Mixed			Short			
				Total	High	Low	Total	High	Low	Total	High	Low	
1	25	4.3	9.1	2	1(-)	1	9	4(-)	2	15	1(-)	9	—
2	30	4.0	8.8	—	—	—	11	4(-)	3	17	1(-)	9	2
3	29	3.6	7.7	2	—	—	13	2(-)	3	14	—	8	2
4	30	3.6	6.7	3	1(-)	—	7	1(-)	5	20	2(-)	9	1
5	29	4.4	8.9	4	4(-)	—	10	1(-)	2	15	1(-)	7	—
6	24	4.1	8.2	5	1(-)	2	7	1(-)	2	12	—	5	1
7	26	4.1	9.9	5	4(-)	1	8	1(-)	3	13	3	3	3
8	28	4.7	9.5	4	3(-)	—	10	—	1	14	2(-)	5	—
9	30	4.1	9.8	5	3(2)	—	7	1(-)	2	18	1(-)	9	1
10	28	3.7	7.5	2	1(-)	—	11	2(-)	1	15	—	11	1
Total.....	278			32	18(3)	4	93	17(-)	24	153	11(-)	75	12
Mean.....	28	4.1	8.6	3.2			9.3			15.3			1.2
% of all groups (G)	100%			12%			33%			55%			

Long groups are those in which number of spikes from minimum to maximum on both sides of maximum is greater than 3.

Mixed groups are those in which number of spikes from minimum to maximum is less than 3 on one side and greater than 3 on the other side.

Short groups are those in which the number of spikes from minimum to maximum on both sides of maximum is less than 3.

High groups are those in which ratio of maximum to minimum is greater than 10. The numbers in parentheses refer to high groups symmetrical with respect to the two minima.

Small spikes refer to number of sequences of three or more spikes less than 2 mm.

TABLE 8  
ANALYSIS OF TEN CONSECUTIVE SECTIONS OF SUBJECT NO. 11

Sample	G	M	B	Classification of Groups									Small Spikes
				Long			Mixed			Short			
				Total	High	Low	Total	High	Low	Total	High	Low	
1	21	3.2	4.7	5	—	3	11	1	9	5	—	4	2
2	29	4.0	6.9	1	—	1	11	—	6	17	—	10	2
3	25	3.4	5.8	4	1	—	12	—	5	9	—	8	2
4	25	3.4	6.6	5	—	1	7	2	3	13	—	12	2
5	30	3.1	5.3	2	—	2	12	—	7	16	—	13	6
6	23	3.3	5.4	2	—	—	14	—	8	7	—	6	5
7	25	3.6	5.5	2	—	1	12	—	7	11	1	7	4
8	32	3.7	6.7	1	—	1	12	1(1)	6	19	1(1)	12	4
9	30	3.8	8.4	1	—	—	13	2(1)	5	16	—	12	3
10	28	3.3	6.1	1	—	—	10	—	8	17	—	11	3
Total.....	268			24	1	8	114	6(2)	64	130	2(1)	95	33
Mean.....	26.8	3.48	6.14	2.4			11.4			13.0			3.3
% of all groups (G)	100%			9%			43%			48%			

Long groups are those in which number of spikes from minimum to maximum on both sides of maximum is greater than 3.

Mixed groups are those in which number of spikes from minimum to maximum is less than 3 on one side and greater than 3 on the other side.

Short groups are those in which the number of spikes from minimum to maximum on both sides of maximum is less than 3.

High groups are those in which ratio of maximum to minimum is greater than 10. The numbers in parentheses refer to high groups symmetrical with respect to the two minima.

Small spikes refer to number of sequences of three or more spikes less than 2 mm.

In Table 8 are presented the G, M and B values and group classifications for subject 11, whose consecutive tracing is presented in Fig. 7. In this case

TABLE 9  
ANALYSIS OF SEVEN TESTS ON DIFFERENT DAYS  
FOR SUBJECT NO. 1

No. of test	Extensors							Mean
	1	2	3	4	5	6	7	
G	23	22	25	21	19	23	21	23
M	6.2	5.1	4.5	5.1	7.4	3.8	4.7	5.3
B	15.7	6.4	10.1	9.0	11.2	12.6	11.1	10.9
Flexors								
G	26	18	22	19	20	27	21	24.0
M	3.4	5.0	5.7	3.9	6.0	3.3	6.2	4.9
B	8.2	7.6	8.8	10.0	12.3	5.2	14.5	9.5

G varied from its mean value of 26.8 by +19 per cent and -22 per cent. Again, consistently with a moderately high G, there were few long groups and many mixed and short groups. The mean value for M was 3.5, the variation for

the individual samples being -11 per cent and +14 per cent. This value borders between low and medium. The mean for B was 6.1, the variation being from -23 to +38 per cent. In this case there were very few high groups, altogether 9 out of the 268 groups for the ten sections. Such few high groups as occurred were mostly scattered among the groups of mixed length. From the analysis this would appear to be a case without obvious grouping.

2) *Repeated tests on the same individual.* To determine the consistency of the indices on repeated tests repeated records were made on 8 subjects at time intervals of 2 weeks to 6 months. The data of seven tests on subject 1 are shown in Table 9. Values are presented for the flexor tracings as well as for the extensor tracings. There is considerable variation for all values in both the extensor and flexor tracings. The mean values however for all values in the ex-

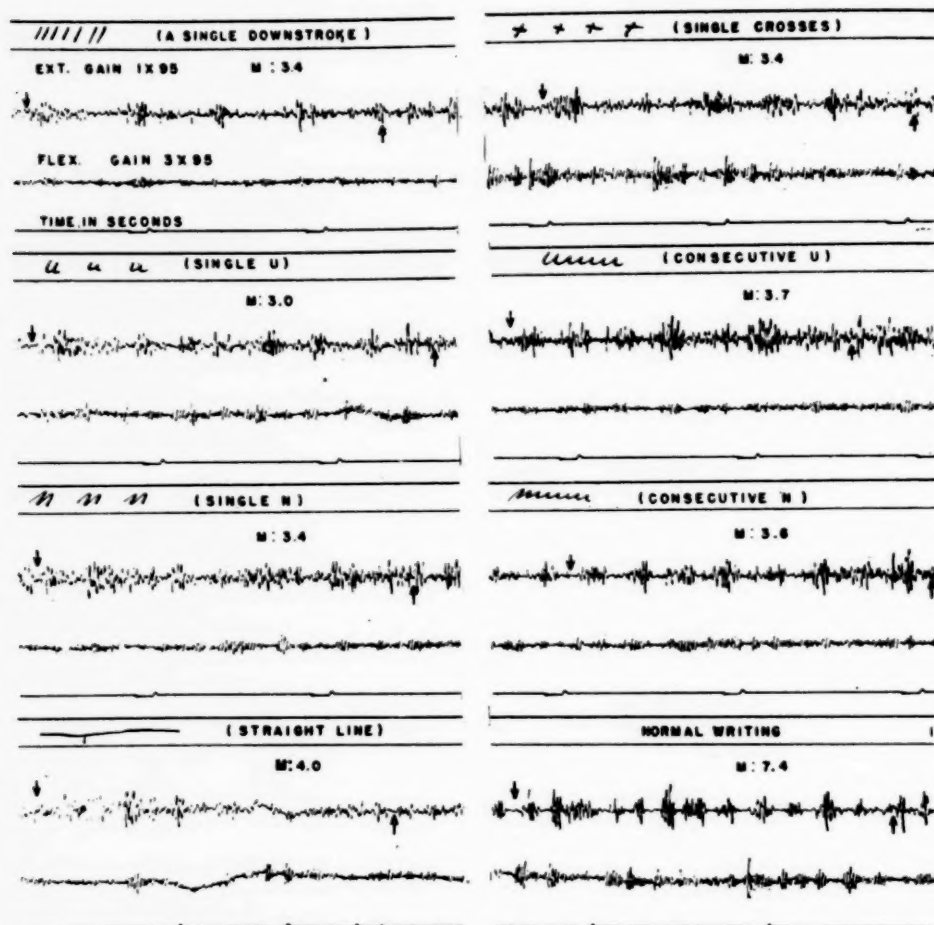
TABLE 10  
INDICES OF SEVEN SUBJECTS REPEATED ON DIFFERENT DAYS

No. of Subject	G	M	B	G	M	B	G	M	B
2	33	5.0	14.9	26	3.5	6.9			
3	21	4.9	9.9	32	3.4	5.1			
4	25	4.5	8.2	27	4.2	6.5			
5	24	4.5	7.6	22	4.7	11.6			
7	25	3.8	6.6	23	2.6	4.0	22	4.1	6.0
9	19	3.6	3.8	27	3.3	7.8			
14	31	3.0	5.5	28	3.8	11.9	23	3.7	5.7

TABLE 11  
ANALYSIS OF CONSECUTIVE RECORDS OF FOUR SUBJECTS ON WRITING VARIOUS LETTERS AND SYMBOLS

Letters or Symbols	Subject No. 1			Subject No. 2			Subject No. 9			Subject No. 10		
	G	M	B	G	M	B	G	M	B	G	M	B
///	27	3.4	10.6	31	5.4	13.4	22	3.3	4.6	31	3.6	8.1
++	26	3.4	9.2	34	4.1	13.4	26	2.8	4.2	28	3.4	10.5
--	26	4.0	9.6	35	4.3	14.9	31	3.5	6.5	29	4.2	9.1
u	32	3.0	9.6	28	4.8	13.5	25	3.8	7.3	27	4.7	7.3
uuu	28	3.7	7.8	33	4.5	12.2	25	3.4	5.4	31	5.0	12.5
n	27	3.4	4.5	26	5.0	13.3				35	4.2	10.8
nnn	28	3.6	10.6	29	9.7	22.5				31	3.9	7.4
normal handwriting	20	7.4	11.2	34	4.9	14.9	28	3.3	7.8	25	3.4	6.9
writing, right to left							29	4.0	8.2			
drawing a church	30	4.3	22.1							30	3.6	11.6
Mean	24	4.0	10.6	31	5.3	14.8	28	3.4	6.3	28	4.0	9.4

# **E.M.G. TRACING OF HANDWRITING OF SUBJECT NO. 1** **VARIATIONS ACCORDING TO THE LETTER MADE**



## **VARIATIONS WITHIN ONE LINE OF HANDWRITING**

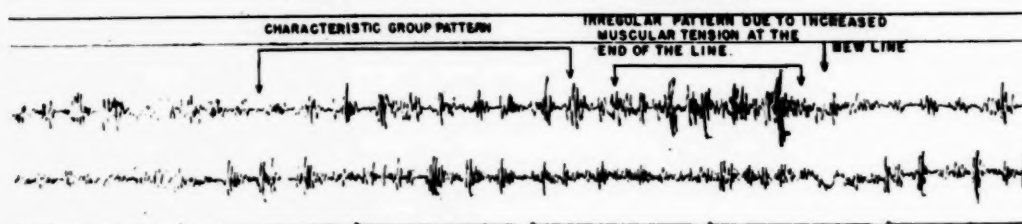
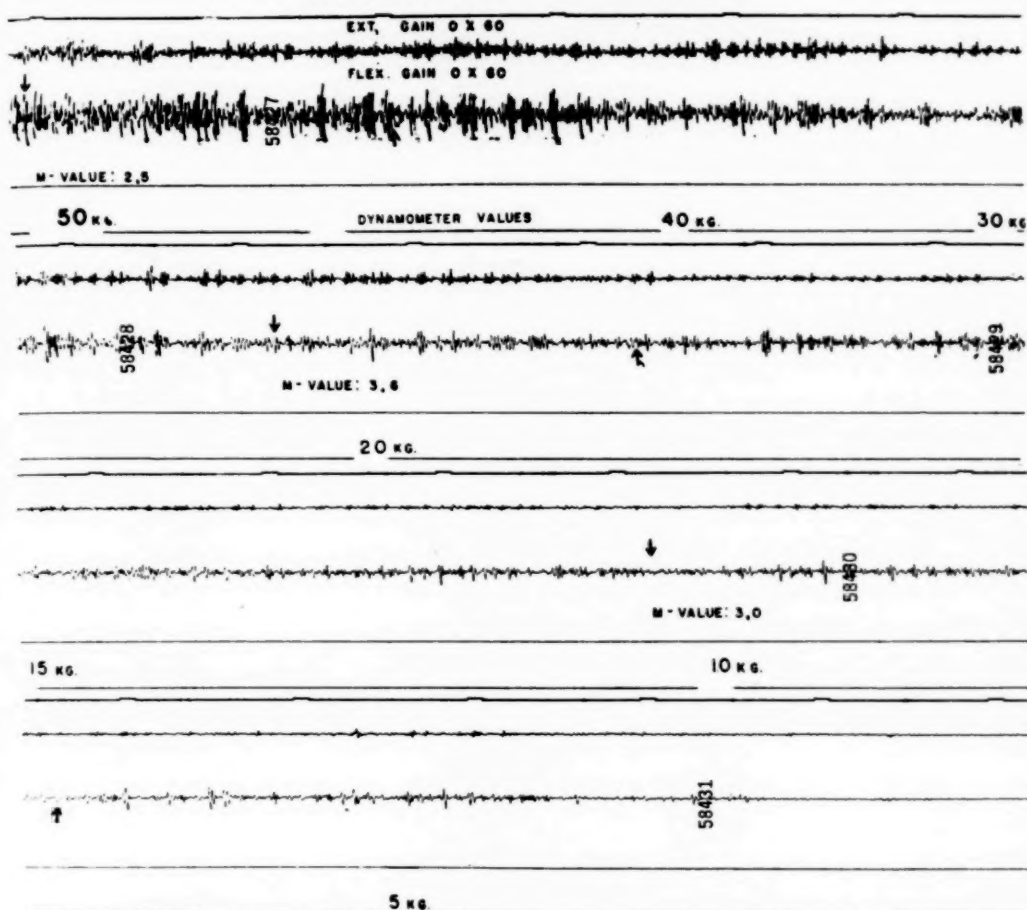


FIG. 9. E.M.G. tracing during writing of various letters and symbols, contrasted with the tracing during normal handwriting in subject 1. The highest M value is seen in normal handwriting. Variations in pattern and in M value are seen in writing different letters and symbols and may even (see bottom record) be influenced by the position of the hand on the paper.

# EM.G. TRACING OF SUSTAINED STRENGTH SUBJECT NO.1 SQUEEZING A DYNAMOMETER



## TENSED BUT NON MOVING ARM

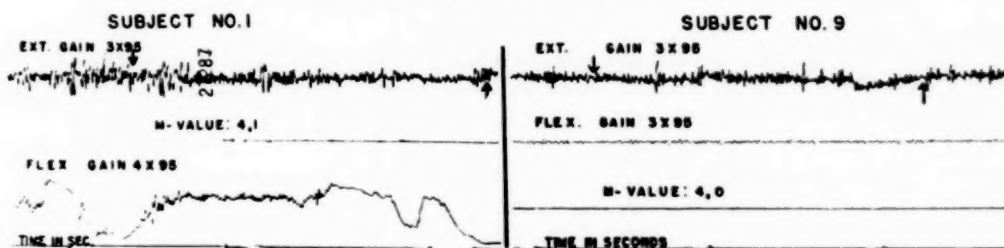


FIG. 10. Consecutive E.M.G. tracing of subject 1 while using decreasing strength as measured by a dynamometer. The M value throughout the tracing is low. It is to be noted that high M values were not found during periods of sustained strength.

tensor and flexor tracings are constant.

The data on the repeated tracings of 7 subjects are presented in Table 10. The time interval between the tracings varied from 2 weeks to 6 months. The analyses of the first tracings were presented in Table 1 but are here repeated for completeness. For two tracings re-

M. Most of the subjects showed a considerable change in G.

*Consistency in writing different letters and symbols.* Records obtained during the writing of letters and symbols. In order to compare the tracings made when different letters and symbols were written 4 subjects (Nos. 1, 2, 9 and 10) were

## E.M.G. TRACING OF MAKING A FIST

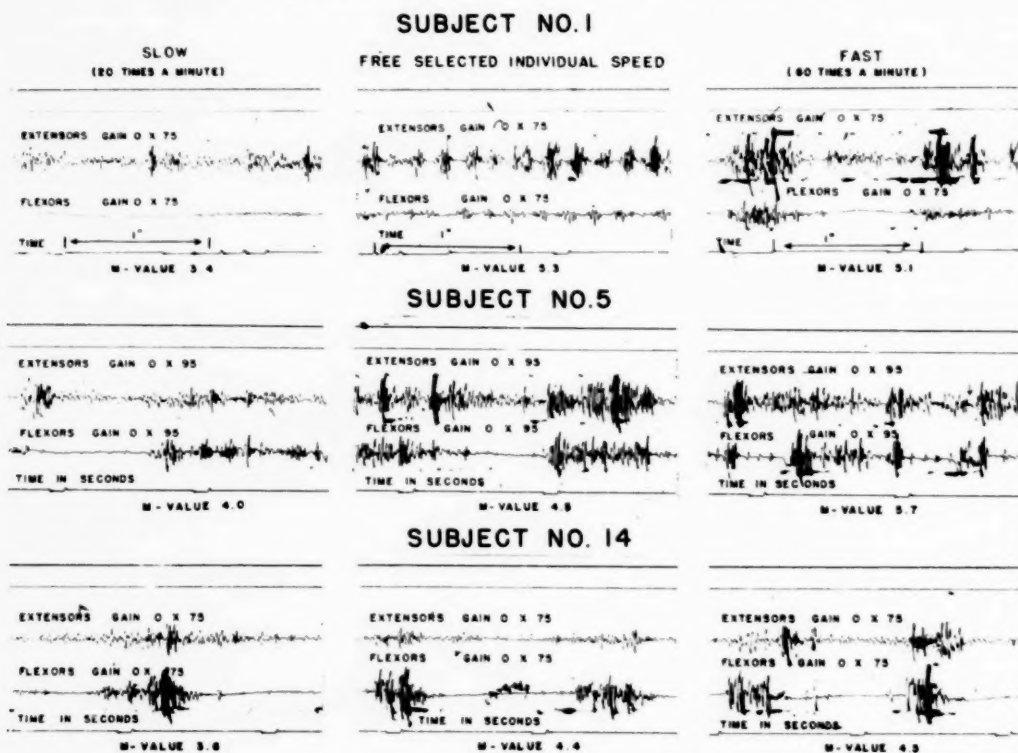


FIG. 11. E.M.G. tracing on 3 subjects while making a fist at different speeds. M values were greater for all subjects during the fast movements (60 times a minute) than during the slow movements.

peated at different time intervals (subjects 7 and 14) the range of variation in the G value was within from +13 to -18 per cent of the mean value. For the M values the range of variation was +17 to -25 per cent of the mean value and the variation for B was considerably greater, being +42 to -39 per cent of the mean. On comparing the G values for the subjects in two tests 4 the 7 subjects showed little or no change and 3 subjects showed little change in

asked to write a variety of letters and symbols during one test. The results of the analysis of these tracings are presented in Table 11, and analyzed for values of G, M and B, and the records for subject 1 are reproduced in Fig. 9.

There is considerable variability in all of the indices for the different subjects. There is no consistent correlation between the type of letter or symbol made and any specific value for G, M or B. Although there is considerable

variation for M, yet the mean values for M for this table are strikingly like the values reported for two subjects on analysis of consecutive sections of handwriting (see mean values, Tables 5 and 7).

(4, 5) that no electrical activity is recorded during complete relaxation. It is known that greater muscular strength is associated with greater action potentials and is expressed in the record as relatively high spikes. It seemed that

### THE INFLUENCE OF THE SPEED OF MOVEMENT ON THE E.M.G. TRACING

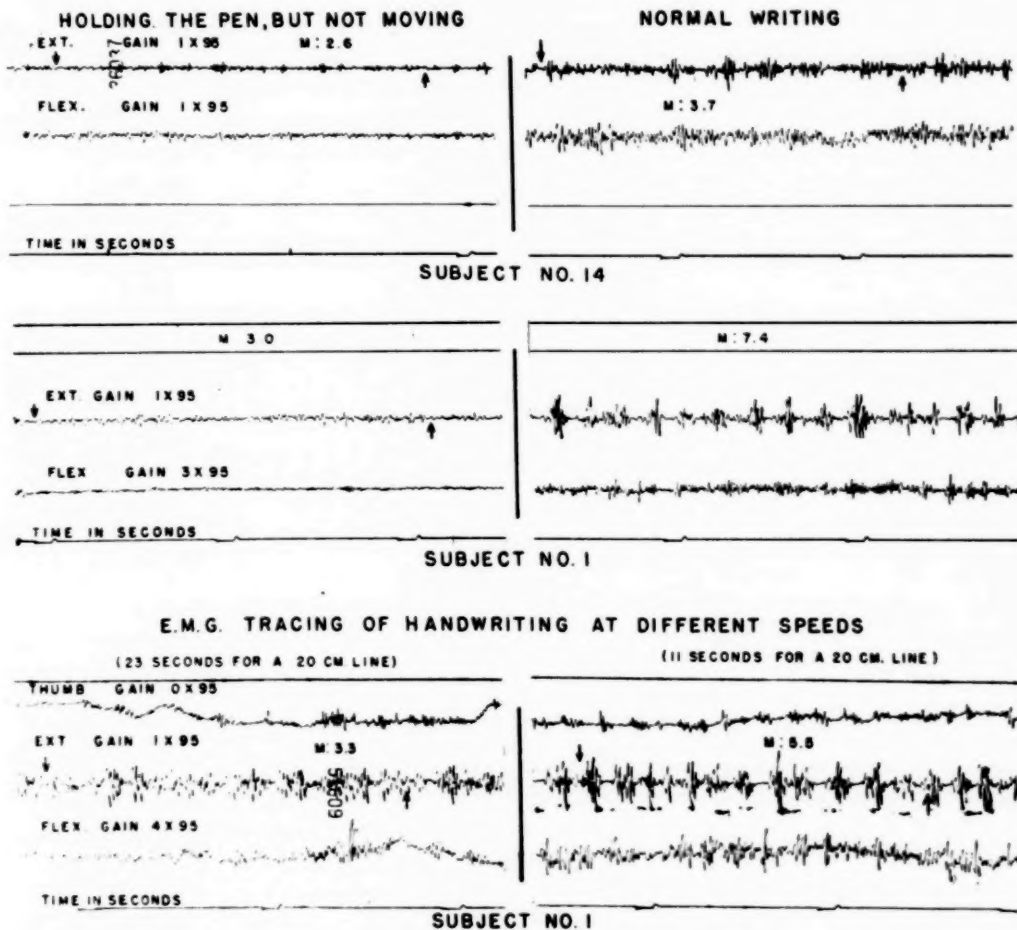


FIG. 12. The E.M.G. tracing of handwriting at different speeds. The M value is greater during the greater speed of handwriting. A greater value for M was observed during normal writing when contrasted with holding a non-moving pen.

*Effect of strength, speed and relaxation. Preliminary experiments.* In an attempt to understand the various elements involved in the production of changes in pattern in the electromyogram a few experiments were made which are here referred to. It has been established

the appearance of a definite pattern in the tracing might be due to the alteration of the three factors of strength, relative relaxation and speed of movement. These preliminary experiments indicated that gradual diminution in strength as manifested by a decreasing

### E.M.G. TRACING OF MAKING A FIST RELATION OF EXTENSORS AND FLEXORS

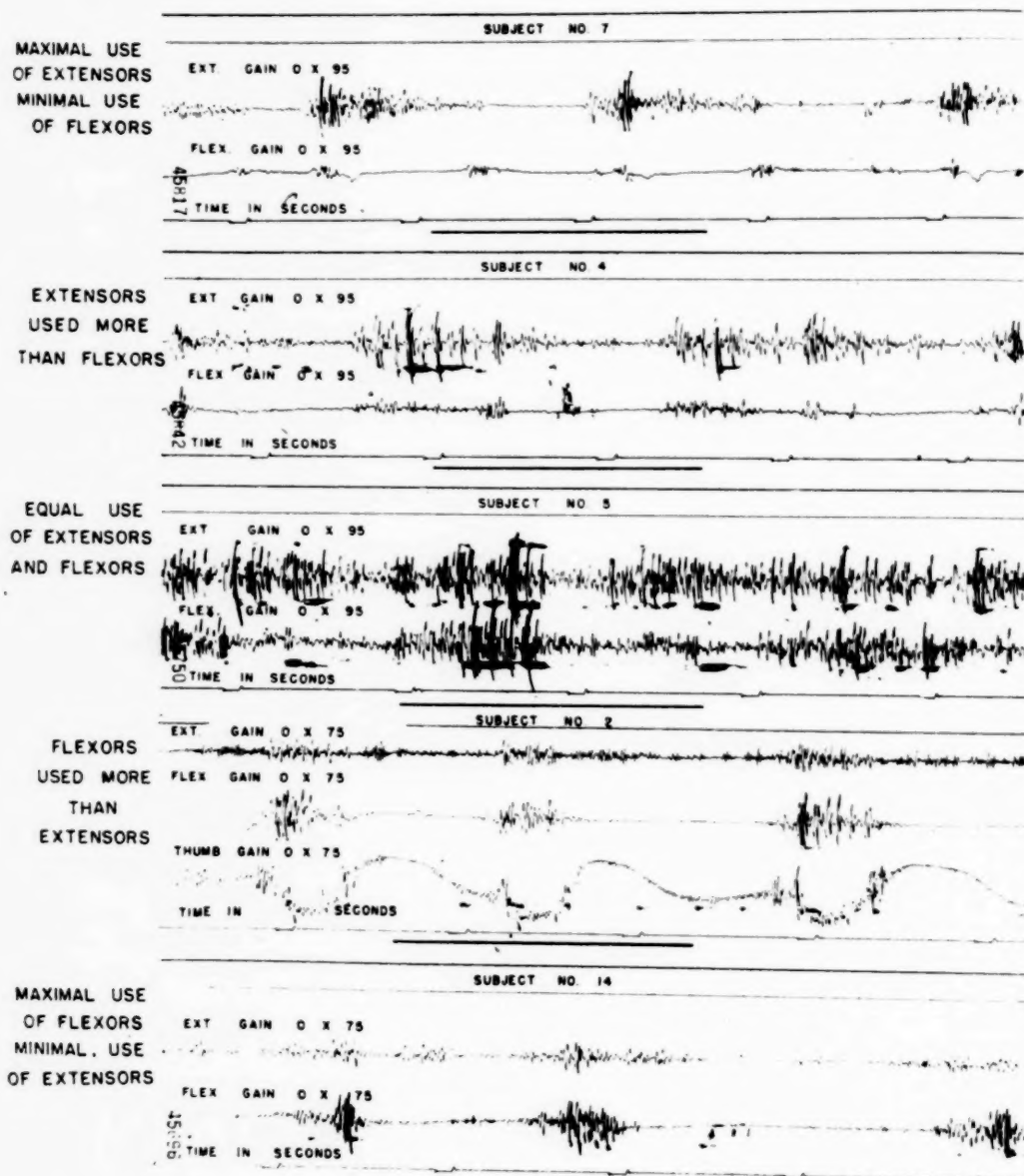


FIG. 13. E.M.G. tracings of five subjects which illustrate the relation between flexors and extensors. Subject 5 shows almost constant activity in both flexors and extensors. This is to be contrasted with the record of subject 7, where periods of inactivity are interposed.

value for a dynamometer (from 50 to 5 kg.) showed a progressively decreasing size of the spikes, without a striking change in pattern or in M value (see Fig. 10). A record of the arm held tense or holding a pen but not moving in subjects 1, 9 and 14 shows (see Figs. 10 and 12) low values for M, which implies the lack of high groups. These experiments indicate that the M value is not changed by different states of muscular tension. It seems that records of different individuals with different M values in handwriting approach a common irregular pattern with low M values when they use tension and strength without movement. That the speed of movement is important is seen in the lowest tracing of Fig. 12, which shows a greater value for M and a more striking pattern formation in distinct groups when the speed of motion is increased. The same fact is illustrated in Fig. 11, in which it can be seen that a slow movement (making a fist 20 times a minute) gave records characterized by low M values and by a relative absence of groups. During a fast movement (making a fist 60 times a minute) the record showed greater M values and a tendency toward group formation. One of the factors determining the pattern of the myogram, *i.e.*, presence or absence of groups, is determined by the speed of activity which is selected by the individual. The state of relaxation existing during a movement would seem to be another factor determining the pattern of the myogram (compare subject 7 and subject 5, Fig. 13). Further studies on the effects of strength, speed and relative relaxation upon the myogram will be reported in subsequent communications.

#### DISCUSSION

This paper is an attempt at analyzing various types of electromyographic tracings obtained during handwriting.

It was undertaken with the aim of developing a technique for studying individual patterns in complicated integrated movements. The use of skin electrodes results in a more complicated electrical tracing than would be obtained by the use of coaxial electrodes, since the skin electrodes permit impulses to be picked up from a larger group of muscle fibers. Since it is precisely integrated activity of the muscle groups which gives to the movement its individual characteristics, the simplified record from the coaxial needle was not selected for study (4, 12).

The records obtained show great variability and many irregularities. Nevertheless certain regularities in the form of patterns or grouping of the spikes can be detected by the eye (see Figs. 2, 3 and 4). In extreme cases (Fig. 1, subjects 1, 2 and 3) the patterns are very obvious as distinct groups which occur regularly. At the other extreme (Fig. 1, subjects 13, 14 and 15) the tracings show an irregular pattern without apparent grouping of the spikes. Any objective evaluation of the patterns should include indices which can be used repeatedly in comparing records from different individuals and during different types of muscular activities.

The consecutive spikes in the tracings were arranged in groups so that each group started and ended with a relatively low spike between which there occurred one or more high spikes. The highest spikes of each group were defined as maxima, and were selected according to an arbitrary definition of their relation to the low spikes or minima. These statistical groups did not necessarily coincide with the groupings of spikes visible to the eye in some of the records. Three indices were derived based upon the number of groups (G), a ratio involving the maxima and minima (M) and a ratio involving the extreme ranges in size of spikes for a

given record (B). These indices were studied in relation to the length, height and symmetry of the groups.

The index  $M$  (the ratio of the sum of the maxima over the sum of the minima for 120 spikes) was found to correlate most closely with the appearance of group patterns in the tracings. Tracings could be divided into three groups in terms of low  $M$  (up to 3.5), medium  $M$  (3.5 to 4.4) and high  $M$  (4.5 and over). High values of  $M$  correlated with long high groups (Table 4) and also with the presence of a large number of very small spikes (Fig. 6), some of which occurred in sequences of 3 or more (Table 4). The tracings showing high  $M$  were those in which groups of spikes were obviously visible to the eye (see Fig. 2). Low values of  $M$  showed a positive correlation with short low groups (Table 4) and also were associated with a relatively small number of small spikes (Fig. 6). Tracings with low  $M$  were those in which the grouping of the spikes was not so obvious to the eye (see Fig. 4). Intermediate values of  $M$  were frequently associated with a visible spindle type of group formation (Fig. 3).

The values for  $M$  indicate that a greater constancy is found in tracings taken at the same sitting on the same day than in tracings taken on different days. Different records may show an appreciable difference in  $M$  for a given individual during handwriting. At the same time a mean value of  $M$ , characteristic and fairly constant for the individual, appears to result when the values of  $M$  derived from 5 or 10 samples of an individual's handwriting are averaged. The possibility that some individuals may habitually make greater use of the extensor than of the flexor muscles and *vice versa*, that some may use the flexors more, is suggested by a comparison of the flexor and extensor tracings for 5 subjects in Fig. 13. In

some preliminary tests carried out to compare foot writing with handwriting for a given individual (Figs. 2, 3 and 4) similar patterns could be seen, and comparable values were derived for  $M$ . The study of the variability of  $M$  for individuals needs further elaboration in the light of such factors as relaxation and speed.

A few preliminary experiments are included in the present study which throw light on the question of the relation between the speed, strength and relaxation of the movement and the presence of groups visible to the eye (high  $M$  values). Several records were obtained in which the speed of movement was increased (Figs. 11 and 12). Analysis of the tracings thus obtained showed the presence of groups (high  $M$  values) for increased speed of movement. The appearance of groups and a similar increase in  $M$  appears when the record for handwriting is compared with that for the same individual holding a pen but not moving (Figs. 11 and 12). Greater application of strength alone (Fig. 10) did not result in an increase in the number of groups (increase in  $M$ ). Apropos of this point one often finds few groups and low  $M$  values in records where there is great muscular strength and tension. The fact that tension is associated with the presence of few groups (low  $M$  values) would give weight to the supposition that relaxation as evidenced by the presence of sequences of relatively small spikes in the tracing is associated with the presence of groups (high  $M$ ). The association of both speed and relaxation with the presence of many groups suggests that relaxation and speed may occur together or even that relaxation may be a requisite for speed of movement. In this connection it is of interest that subject 1 (Fig. 2), who had a fast handwriting, showed definite, regular patterns in the electromyogram tracing for hand-

writing with many obvious groups and periods of relative relaxation, whereas subject 14, who had a slow handwriting (Fig. 4), showed an irregular electromyogram tracing with few obvious groups and no periods of relaxation. In both cases footwriting seemed to show the same pattern as handwriting. It would seem reasonable to assume that the presence of tension in a movement (few groups, low M) plays a rôle in the efficiency of a movement.

This study seems to indicate that the evaluation of myograms during constant movement would throw light on the more general problem of tension and relaxation in their broader aspects. Investigations on the relationship between the factors of speed, relaxation and tension as seen in complicated, trained movements will be reported subsequently.

#### SUMMARY

1) Electromyographic tracings obtained during handwriting on 15 subjects are presented. A few tracings obtained during attempts at foot writing and making a fist are presented.

2) A method is presented for the statistical analysis of the tracings, based on the measurement of successive spikes. The individual groups are defined in terms of successive maxima and minima and indices are derived which are used for the comparison of tracings.

3) The index M (ratio of the sum of the maxima to the sum of the minima) gives the best characteristic of an electromyographic tracing.

4) The interpretation of various tracings and the influence of strength, speed and relaxation are discussed.

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## PSYCHOSOMATIC CORRELATIONS IN ALLERGIC CONDITIONS

A REVIEW OF PROBLEMS AND LITERATURE

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### THE SKEPTICAL ATTITUDE TOWARDS PSYCHOGENIC FACTORS

A PSYCHIATRIST, recently reviewing a paper of a dermatologist on psychosomatic relationships in skin diseases, asked the dermatologist why he felt it necessary to use such determined and even controversial language in dealing with disputed cases in the dermatopsychiatric terrain. He suggested that since practically every other branch of medicine had accepted the psychosomatic as an integral part of its etiologic conceptions, dermatologists probably had done likewise, and the controversial spirit should be abandoned. While accepting this philosophy of the other cheek, so to speak, it must be remarked that the relatively recent literature of dermatology contains, as does that of allergy from the dermatological standpoint, references to the neurogenous factors in skin disease which might arouse the feelings of the psychosomatist to battle heat. Certainly dermatologists have by no means accepted the sudden flood of emphasis on psychosomatic influences as they conceive them, in skin etiology. O'Leary, for example, in discussing van de Erve and Becker (75) on functional studies in patients with the neurodermatoses, expresses himself in what might be regarded as conservatively skeptical terms—"The authors admit in their presentation that there is an intangible element in neuro-

dermatoses or dermatoses of neurogenic origin, a premise with which most dermatologists are in accord. I confess a certain degree of coolness for the concept of neurogenic dermatosis as expressed by them. I can sum up my impression by repeating the sage comment that, when we believe, we stop thinking. If a larger series of control cases of dermatoses, other than those which the authors call neurogenic were included in this appraisal, the same or similar incidence of high strung personalities might be encountered." (The authors subsequently called attention to the fact that they had used Peterson and Levinson's (58-1) series of 100 supposedly normal individuals as controls.)

Similarly Sulzberger in his textbook, "Dermatologic Allergy" (1940) (72) dismisses in unmistakable terms the pretension of psychosomaticists to a place in the race for etiologic importance in conditions such as atopic dermatitis and the eczema-asthma-hay fever complex. "I know of no way of gauging with accuracy such imponderables as 'nervousness,' 'tension states,' 'temperamental difficulties,' and 'protoplasmic instability.' Therefore, in gaining impressions I have been obliged to rely solely on close clinical observation. Perhaps psychiatric and neurologic studies of this group, and the use of precise objective neuropsychiatric methods would yield results different from mine.

"Of course, Dr. Goodman and I have encountered 'nervousness,' 'irritability,' and the like in a few of our cases. But

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we have found no proof that this 'nervousness' is causal in the production of a dermatosis. In our material, we have gained the impression that these occasional instances of 'nervousness' were 1) purely coincidental, 2) concomitant (*i.e.*, psychoneurologic disturbances caused by the same factor or factors which produced the dermatologic manifestation) or 3) clearly the entirely comprehensible result of and the normal reaction to the dermatosis and its 'maddening' itching, loss of sleep, continuous worry about disfigurement, about the future, about economic and other personal and related conditions." Continuing Sulzberger points out that "the older designations of neurodermite, neurodermatitis, angioneurotic edema etc., have nothing to do with the present meaning attached to the words, nervous, neurogenous, neurotic etc."

It is still clear, then, without mentioning further specific instances, that there is room for much psychosomatic study among dermatologists and dermatallergists in this country at least. Macfie Campbell's (9) address before the College of Physicians, Philadelphia, on "Emotional Factors in Health and Disease" well expresses one of the crucial difficulties.

"Happy the specialist who has a well-defined vocabulary at his disposal, who works in a field where the terms are technical and explicit, who can give an ocular demonstration of the object to which he refers, who can isolate the dynamic systems of which he talks! Unhappy the psychiatrist whose language is a blend of ordinary speech with its lack of precision, and of technical terms whose apparent precision masks misleading assumptions and great divergence of opinion!"

"In this dilemma the psychiatrist is entitled to appeal to the psychologist, as the internist may depend on the physiologist for the precise definition of

fundamental life processes."

Dermatologists and allergists, like all new groups in the specialisms of medicine, pass through a stage in which they resist liaison with their neighbors in other fields of medicine, as one of the unconscious devices for establishing their individual autonomy and identity. The accustomedness of the dermatologist to the visible and structural which, in the field of skin diseases, is a constant temptation to superficial thinking as well as an advantage in study and classification, is a possible factor in the reluctance with which the psychogenic problems have been admitted to the fold of causes in diseases of the skin. A highly objective, highly "ocular" speciality in which enthusiasm for the photographic, and dominance by the photographic type of mind is a natural consequence of the character of the material, tends perhaps to be slow in acquiring a functional viewpoint either in diagnosis or research. One might almost say that until relatively recently only self-infliction, recognizable by the bizarre and unclassifiable physical outlines of the lesion, was admitted to the field of the psychogenous in diseases of the skin. There is also recognizable in medicine in general, a disposition to think in terms of sole causes rather than complex interacting factors. This sole-cause attitude of mind has perhaps an admirable cutting edge in exposing the etiology of a relatively unknown group of ailments; but it must give place ultimately to a viewpoint which recognizes multiple causation and interrelations as equally fundamental with if not more fundamental than the single isolated cause. The psyche rarely appears in dermatoses as a sole cause, and for that reason has met with more difficulty in acceptance, perhaps, than have fungi, body cells and so forth. It must be conceded also, we believe, that the current business of becoming a spe-

cialist works to some extent antagonistically to a thoroughgoing familiarity with the scientific groundwork of the specialty in the field of general medicine and physiology. Dermatologists themselves have recognized this, and have used or recommended various methods of keeping their specialty in touch with basic conceptions. It is therefore only a mild exaggeration to say that as soon as the dermatologist becomes aware of fundamental physiology, especially in the vascular and sweat fields of his specialty, out comes a paper on the psychological background.

It would seem also from the material of dermatologic discussion of the psychogenic problems, that unfamiliarity with the related fields of asthma and hay fever, and the progress which has been made in the psychological study of these conditions, limits the outlook of the dermatologist on that group of so-called neurodermitides which stands in close relationship to allergy and the asthma-hay fever complex. This, however, can hardly be said of the allergist who surely has abundant opportunity to recognize in the vasomotor neuroses important elements in his allergic field.

It must be clearly recognized, however, that the skepticism of the dermatologist and allergist contains much that is basically sound and vital. First of all, there is the question raised by both O'Leary and Sulzberger of the cart-horse relationship. Which comes first, and which is causal—the dermatosis or the neurosis? All sides, we believe, really recognize that there is every reason to expect the condition of the skin to influence the personality, as Sulzberger points out, but the reverse is perhaps less clear. One of us has remarked that until the physical expression of personality in the vasomotor and sweat systems can be subjected to rapid and exact measurement under varying

conditions there will always remain a group of "hard factors" who will insist that personality is cart and cutaneous lesion is horse. Some relief from the tension engendered by this attitude of mind can be found in the acceptance of the vicious circle so constantly instrumental in other fields of medical causation. It does indeed, at times, become extremely difficult to decide whether the skin disease made the person what he is, or the person made the skin disease.

O'Leary's point is also well taken and insisted on even by dermatologists interested in the psychosomatic, that there are inadequacies on the dermatological side at least, in the study of the psychogenic background of persons with normal skins and nonpsychogenic dermatoses. One of us has again said on several occasions that until there is a large-scale psychologic study of supposedly nonpsychogenic dermatoses to place side by side with the allegedly psychogenous, most of the current seesaw of discussion will go on to no purpose. It is clear, therefore, that such studies as Obermayer and Becker's (54) and van de Erve and Becker's, mentioned previously are attempts in the right direction, and should be as systematically encouraged as the work of Draper (16) on human constitution.

It is notable too, that such work as Mittlemann and Wolff's (51) study of ordinary individuals by a precise instrumental technique, should be more familiar to dermato-allergists like Sulzberger, and should be subjected to the critical review of controlled repetition rather than dismissal as "imponderable."

Finally, it is clear from survey of the literature, as well as from travel and acquaintance, that there is a conspicuous lack of liaison effort between dermatologic and psychiatric clinics. The interesting and fruitful results that

have sprung from such a liaison between Gillespie's and Barber's clinics at Guy's Hospital, should encourage further effort in this direction as soon as the parlous state of the world permits. There is certainly no reason why skin physiology with a neuropsychiatric background should not similarly be attacked in this country in the near future. All that seems necessary is the money and a get-together spirit.

#### CURRENT DERMATOLOGICAL CONCEPTIONS APPLICABLE IN THE PSYCHOGENIC FIELD

##### VASOMOTOR AND SWEAT PHENOMENA

The "Blush concept"; conflict from various sources and stigmatization as observed in subjects under hypnosis and in religious ecstasies (thus far the only published examples) are coming to be recognized in the literature as fundamental links between dermatology and psychiatry. Free use, for example, has been made by Klaber and Wittkower (36) of the blush concept in recent interpretation of the mental state of the rosacea patient. Rogerson (61) has expressed the belief that sweating of the palms has almost invariably a psychogenic background. Klauder (38) in his study of the religieuse Thérèse Neumann, provides the basis for an interpretation not only of vascular lesions as an expression of stigmatization, but of a fundamental influence of the mind on the distribution of a vasomotor skin reaction. Writing with Ingraham in a review (70) of these problems, we pointed out that while clinical observers quite freely recognized the influence of emotional reactivity on skin color, there has been a notable deficiency of colorimetric studies of the influence of emotion on the vasomotor mechanism. One reason for this has been the slowness and cumbersomeness of spectrophotometry as demonstrated by the apparatus of Sheard and others (67). It is

possible that the improvement effected by Hardy (27) (and further improvements to be expected under industrial stimulation) may make possible direct analysis of the emotional color changes. The psychogalvanic reflex, which has been thought to reflect the state of the terminal capillaries of the skin, is still a matter of controversy [Densham and Wells (13), contradicted by Darrow (12)]. Williams (79), with careful consideration of the control factors, has apparently shown that intramuscular administration of histamine to individuals who have so-called atopic dermatitis (the EAHF complex) produces an increase of skin temperature of the sites of predilection for this condition—that is the face, neck, and upper part of the chest and flexures of the elbows and knees, whereas the increase of skin temperature in normal persons is limited to the face and neck and is not observed in the flexures. It is suggested by him that increased reactivity of these sites to histamine, when injected intramuscularly, may be a factor in the characteristic localization of atopic dermatitis. Ziegler and Cash (81) have reviewed a considerable literature on vascular mechanisms. Their material is largely psychopathic, and a wide variability in reaction was observed. The opinion was expressed by them that cerebral heat control is centered in the hypothalamus.

To quote from our before-mentioned review, "The influence of sweat on the pH of the skin, on the concentration of secreted reducing bodies on the skin surface, and also in the case of certain glands (apocrine) of soluble proteins and odoriferous substances, is one of the important linkage mechanisms in the effect of emotion on pathologic conditions of the skin. Kuno's (11) excellent review of the physiology of human perspiration (1934) gives great weight to the emotional factor in sweating.

The two embryologic groups of sweat glands, the apocrine and the eccrine, are clearly differentiated in their behavior by all students of the subject, and an excellent review of what is known of the physiology of the apocrine glands since Schiefferdecker's (65) fundamental investigation is given by Way and Memmesheimer (77). Apocrine sweat gland distribution occurs only in the hairy region of the axillae, the mons veneris, and the perineal and circumanal regions, the anterior abdominal wall, and the areola and hair follicles about the nipples.

"The interest attaching to the apocrine group of sweat glands arises particularly from their embryogenesis and close relation to the sexual mechanism. They develop at puberty, remain active throughout the larger part of the individual's life, and are markedly influenced by stimulation of sexual, mental, and nervous reactions. So marked is the relation of the apocrine sweat glands to cyclical sexual phenomena in women that they have come to be regarded essentially as accessory sexual glands" (Way and Memmesheimer). Loeschke (44) noticed their participation in the sexual cycle; Waelsch (76), Kayser (35), and Seitz (66) confirmed these observations, and the studies of Herzenberg (30) have led to the belief that apocrine glands are influenced by physiologic rather than pathologic sexual occurrences. Occasional case reports, and in all probability, much unreported material, attest the great psychogenetic importance of abnormalities of apocrine sweat secretion. The eccrine gland secretion is of a markedly lower pH than the apocrine, and it is the secretion of these glands over the largest part of the body surface which maintains the so-called acid-defense mantle. Secretion of the regional apocrine sweat glands, on the other hand, at a much higher pH than the eccrine

is much more favorable to the growth of fungi and other infective organisms and is an important factor in the localization characteristics of certain intertriginous dermatoses, including the streptolevurids or streptomycoses of Ravaut (59) and his co-workers.

Kuno (72) points out in summarizing a number of investigations that the weight of present-day effort tends to show that all sweating is centrally controlled through sympathetic fibres. Pituiratin injected into the region of the hypothalamus via the cerebral ventricles gives rise to extraordinary sweating which does not occur when the drug is introduced in other ways, Cushing, (77). The rôle of pituitrin in the production of sweating is, however, by no means clear. The sweat secretion which is most obviously influenced by mental states is that of the palms, soles, and axillae. Kuno considers this to be controlled by a special center in the mid-brain, different from the general sweat control. It may occur under so simple an effort as the adding of a column of figures. Stokes had a patient whose palms never sweated excessively except on saying good-bye to a stranger. Inhibition of sweating, as well as excitation of it, can occur under mental stress. Gillespie (23b), for example, cites a case of a woman whose hyperidrosis began with her engagement to marry a man whom she did not love, and continued because of the conflict between her sense of duty, and her enforced dependence on her husband, with her desire to dissolve the marriage.

Recent technical contributions to the experimental approach to the sweat secretion have been made by Roth (63) who painted the skin with streaks of a solution of cobaltous chloride and observed the regional color changes; Anderson (2), who devised a method of measuring sweat output by paper saturated with cobaltous chloride; and

Buley (8), who devised an apparatus permitting the collection of sweat from individual glands, with quite accurate estimates of the rate or secretion under various stimuli.

Direct neural and neurovascular control over the behavior of the skin involving psychogenic mechanisms has reached a new importance through increasing knowledge of the Lewis-Dale (45) conception of cutaneous "triple reaction" in its relation to herpetic, dermatitic, diffusely inflammatory and urticarial lesions in the skin and the function of acetylcholine as the chemical intermediary between the nerve terminus and the muscle fibre in the parasympathetic factor in the nervous control of circulation and other functions. Several notable papers based on these conceptions, dealing with urticaria particularly, as a "cholinergic" phenomenon, deserve mention. Grant, Pearson and Comeau (25) report observations on urticaria provoked by emotion, exercise and heat, in which the clinical correlation, described some time before by Duke (17), is adequately substantiated and the mechanism made clear. These observers found that the urticaria was provoked through efferent peripheral nerves when these were stimulated by emotion, by exercise, or by warming the body. The experimental technique involved the immersion of the legs of a patient with "heat urticaria" in hot water; after the circulation in one arm was obstructed. This was followed by a general urticaria except on the ischemic arm. If warming was stopped, the patient cooled, and the circulation restored; the rash subsided, and intense urticaria quickly developed in the previously ischemic arm. This indicated clearly that H-substance was released in the skin of the arm while the circulation was arrested, and in response to warming of the legs. Grant and his associates adduced "further evidence of

the release of H-substances during occlusion" by first congesting the arm before arresting the circulation and repeating the experiment just described. When the urticaria began to develop on the free arm, numerous bluish spots of local vasodilation appeared in the skin of the congested and occluded arm. These spots were found to mark the places where the wheals quickly appeared when the circulation was restored. The authors believe that this indicated that the stimulus (H-substance) was released in the skin through the peripheral nerves, since the nerves constitute the only functional connection between the ischemic skin where H-substance was released, and the body where the stimulus was applied. Blocking of the cutaneous nerves in three of the cases prevented the development of the urticaria in the areas of distribution of the nerves in response to warming of the legs. They felt that this demonstration satisfactorily indicated a neurogenic cause for the urticaria. The nerves involved were probably cholinergic since the urticaria was also provoked by choline derivatives, given subcutaneously or applied locally. Accordingly, they felt that the urticaria appearing in response to warming the legs was due to "the release of acetylcholine in the skin as the result of stimulation of the cholinergic nerve fibres. This release of acetylcholine in turn leads to the liberation of H-substance in skin cells." Marchionini and Ottenstein (47) had suggested that sensitiveness in the patient's skin to sweat was an important factor in the production of the urticaria, but Grant and his associates could find no evidence to support this view. They further described a condition of unresponsiveness in the vessels. Hopkins, Kesten, and Hazel (31), reporting on the clinically familiar emotionally induced urticaria brought on by anger, were able to confirm the work

of Grant and his associates and to extend the observations on urticaria, produced by iontophoresis of mecholyl, and intradermal injection of various choline derivatives. They confirm the significance of Duke's classification of these patients as local and general reactors, and they state that the locally produced urticarias have no emotional foundations. In certain subjects (Harris, Lewis and Vaughan) (29) passive transfer of these localized urticarial manifestations indicated they were circulatory in origin rather than neurogenous.

It is not proposed here to review the contributions bearing on the gastrointestinal mechanism as a factor in the behavior of the skin in response to emotion, since this has been adequately reviewed elsewhere on several occasions.

#### STUDIES OF THE PRURITUS MECHANISM

The association of itching with the psychogenic background has so long been recognized that recent contributions on the matter deserve special mention. Desaux and Antoine (14) in a suggestive study entitled "Reactions of the Skin to Nerve Reflexes Originating in the Stomach and Intestines in the Adult" lay particular stress on the disturbances of blood flow which probably influence pruritus, and serve as the origin of scratching and of neurodermatitis. They maintain that dilatation of the stomach is capable of producing marked responses both in the sweating and the sebaceous secretory mechanisms of the face. They concede the great importance of the well-known vasodilator effects produced by the gastrointestinal tract, particularly in the flush area of the face, but do not, like Klaber and Wittkower, associate it with gastric hypotonicity. Brack (6), in an extended and involved consideration of the mechanism of itching, draws a sharp distinction between a species of

threshold susceptibility to itching (Juckbereitschaft) and actual itching itself. He points out that there is a normal threshold of capacity for itching present in practically all persons, and that it is capable of proceeding towards abnormality or heightened sensitivity in the direction of either sympathetic or parasympathetic abnormalities. His presentation contains interesting comments on the production of itching by slight invisible vasomotor changes in the skin, and correlates itching with the hemoclastic crisis in what he apparently considers an important etiologic relationship. The predisposing causes of itching work chiefly in the field of Juckbereitschaft, and are often both more numerous and quite distinct from those responsible for the actual itching. In view of this clear separation of the itch problem into two subdivisions, Goldsmith's (24a) observations on the clinical side in a study of dermatoses in patients with nervous diseases, and those without, are interesting. He points out that pruritus depends upon peripheral perception both for pain and touch; that itching is received centrally in the thalamus, the cortex apparently having little or nothing to do with it. He mentions the demonstration of central or thalamic itching in cases of thalamic tumor without peripheral manifestations. He further points out that there certainly occur in the normal skin slight itching or prickling sensations (minor expressions of the Juckbereitschaft?) and that the degree of attention available for them is generally so slight that they pass unnoticed, and need to be greatly intensified in order to enter consciousness. His point is that it is sometimes not the sensation of itching that is intensified, but the attention factor. Bickford (4), on the basis of a study of histamine reactions in the skin, also points out that itching phenomena can be grouped into two

categories; the actual itch itself which occurs at the site of the stimulus, and "itchy skin" which is a sensory reaction of the surrounding uninvolved areas. "Itchy skin" which may be perhaps compared to some extent with the *Juckbereitschaft* of Brack, arises through a local axonic pathway separate from that responsible for hyperalgesia and for the vascular flare. The nerves responsible do not, he believes, belong to the sympathetic system. The itchy skin sensation may be abolished by a degree of asphyxia which leaves spontaneous itching unaffected. A similar dissociation may be produced by cooling and nerve shock. This, he believes, indicates that the nerves carrying the two sensations are separate. Milian (50) in a recent review of the nature of eczema argues on clinical observation and theoretical grounds that itching must be not of peripheral but of central origin, arising in the sympathetic bulbo-medullary center. The associated capillary dilatation, edema, and secondary vesiculation are related to abnormal function of the sympathetic nervous mechanism and its threshold susceptibility to itching. Lortat-Jacob (46) demonstrates the definite association of the sympathetic nervous system and pruritus, erythema and vesiculation in the background of contact allergy. He cites a case of a fifty-year-old woman who had a more or less generalized eruption since 1929, and had worked with synthetic vanilla since 1925. The patient gave a positive patch test to vanilla on the left arm, but not on the right. She was then given an intradermal test which provoked generalized itching. When pilocarpine was administered, her eruption extended to the point of severe generalization. She was then given atropine, which caused the eruption to disappear, and the patch tests of the supposedly offending substance to become negative.

Klauder's (37) discussion of pruritus points out that itching, like pain, may appear at the site of psychic fixation, as is well exemplified by the topalgias of Blocq (5). To quote, "The foregoing serves to explain itching and other subjective sensations at the site of psychic fixation in the dermatophobias, and psychic diffusion of itching. By psychic fixation and, perhaps, too, by mental representation, the sensation of itching continues after a pruritic disease has been cured and the skin becomes objectively normal, as, for example, the continuation of itching after scabies or pediculosis." The localization of itching frequently manifests the influence of events, recollections or conceptions, for which statement he gives a series of case illustrations. Pruritus may also in Klauder's opinion, be the expression of a fatigue or anxiety neurosis, of mental conflict—symbolic of soul pain, and as an expression of a dermatophobia. Sack (64) and Werther (78) as well as Klauder have reported case examples. Klauder believes that the sexual and lustful elements of pruritus have been overemphasized, but he cites Bronson (7) as pointing out that the voluptuous sensations that may attend pruritus are a manifestation of a generalized aphrodisiac sense, and Sack published case records in which treatment by psychoanalysis and hypnosis was employed. Ingram (33), whose astute commentary on the constitutional background of cutaneous disease makes excellent reading for dermatologists, speaks of the "itch of desire" as an established fact. Klauder accepts the rather high proportion of the psychogenous in patients with pruritus vulvae and pruritus ani and agrees with O'Donovan (55) on this point. Senile pruritus, Klauder also believes is frequently a psychoneurotic symptom, and becomes an obsession in many cases. The characteristic of sitting quietly with the hands folded in

the lap as the individual describes intolerable itching is mentioned. Goldsmith (24b) in his most recent review of the pruritus problem emphasizes a wide range of background apart from the psychogenic which itching may have, including focal infections, malignant disease and so forth, but in the psychogenic field states that itching can have a purely psychogenic origin, independent of the excitement of the peripheral end organs. Goldsmith believes that psychological factors are predominantly responsible for itching in a small proportion of cases only.

#### THE PSYCHONEUROGENOUS "ALLERGENS"

American allergists have been notably skeptical of or indifferent to the possible psychogenic correlates of allergic phenomena, developed by German and British observers especially in the case of asthma. There is a total absence of articles or references to psychogenic correlations in the literature reviews of one of the most important American journals of allergy. The work of Fock (21), Moos (52), Römer and Kleemann (62), Laudenheimer (43) and Hansen (26) is apparently not too familiar to American workers. Hansen, a decade ago, stated that allergens work only in certain psychic constellations; that the patient might be sensitive at one time and not at another; and that of several persons exposed to the same allergens, only one may react because of the so-called individual susceptibility. He denied to any form of psychotherapeutic approach the ability to alter the fundamental allergic background and cited as evidence patients who had lost their symptomatic reactions to their allergens without losing their positive cutaneous tests. Gillespie (23c) points out, in a discussion of the psychological background of asthma, that some specialists seem to have great difficulty in appreciating the parallelism between an

asthma produced by injecting a vaccine beneath the skin, and an asthma which is elicited by the injection into the patient by way of conversation of a topic that "gets under the skin" in a figurative sense. Emotion, he states, may not only elicit individual attacks, but even produce a state of tension which every now and then may reach the explosion point in a paroxysm of asthma. In individuals sensitive to a given allergen, the mere sight of the offending substance or an artificial representation of it (*viz.*, painting, model, etc.) may provoke asthma, urticaria, etc. (71, 74). Illustrative cases are part of the older literature. Gillespie's analysis of the breathing relation of various emotional states to asthmatic breathing (conception of breathlessness and closed space) can be linked with Wittkower's (80b) patient, who could divert an attack by opening the door of her room and looking out onto an open space beyond. The behavior pattern in such material strongly suggests that something more than a physical allergen—or perhaps what might be called a psychological allergen—is adequate for the provocation of asthma, and by inference, to exacerbations of the asthma-linked dermatoses. Rogerson (60) cites the case of a child allergic to fish at home, but not allergic to the same fish under the conditions prevailing at the Southampton Sanitarium where the child was free of his asthma and eczema. A more crucial type of evidence of the influence of the psychogenous in allergic skin reactivity appeared, of course, with the work of Diehl and Heinichen (15). Their ability to change a wheal reaction to an allergen in controlled conditions under hypnosis has now been confirmed by the observations of Marcus and Sahlgren (48), who, in a thirty-six-year-old female psychopath, succeeded in demonstrating that her cutaneous reactivity to a linoleum extract to which

she was sensitive, could be inhibited almost completely by suggesting under hypnosis that the injected allergen was another substance. The same inhibitions were obtained in a case of pollen extract, and it was even found possible to inhibit a tuberculin reaction. Kartamischew's (34) remarkable feats with hypnosis, in this field particularly, need confirmation, we believe, before they can be wholly accepted. Dunbar (19) quotes Metalnikov (49) as having demonstrated in animals, caterpillars, rabbits and guinea pigs an effect of the nervous system on inherited and acquired immunization which in the animals has indicated that a conditioned reflex could be brought into play by diverse stimuli which provoked a discharge of agglutinins and alterations in blood count. It is suggested that the vegetative disturbance accompanying intense conflict may make an organism susceptible to substances not generally pathogenic, a phenomenon which may disappear with restoration of equilibrium. It may be said, however, at least that there is a slow accumulation of evidence for the belief that in the allergic seizures that have close relation to cutaneous medicine, and particularly in urticarias and eczema, psychogenic factors and an approach by way of hypnosis are capable of modifying materially the so-called allergic reactivity of the skin.

#### THE ALLERGIC PERSONALITY

The impression that the allergic subject has a more or less distinct personality has been gaining ground. It is worth while at this time, for the use of dermatologists and others desiring to make comparisons of the allergic personality in cutaneous disease with the allergic personality in asthma and hay fever, to review the essential elements of Dunbar's (19) admirable résumé of the asthma-hay fever

personality problem. In her analysis of three cases, she recognized in all disturbances of sexuality, including alienation from the female rôle in the woman and feminine identifications in the men (this being rated as a non-specific element); and a marked predominance of anal and oral sadistic material, involving sexualization of the respiratory function and great interest in the sense of smell. The compulsive character of the patients was clearly recognized with an ambivalence which did not separate them from reality as does the ambivalence of schizophrenics. Their hostility seemed constantly on the point of being carried into action, and they were in constant terror. In the symptom-free period, according to the literature, asthmatic and hay fever patients exhibit cyclothymic behavior. There is not only intense hostility and aggressiveness, but also a marked tendency to act these out. In other words, there seems to be little intervening between fantasy and actually doing what is fancied. The validity of Dunbar's (19) observations on her material was attested by their conformity to the descriptive outlines of the literature, and the successful elimination psychotherapeutically of the symptoms while the skin reactions to the specific allergens remained unchanged. The alternation between symptomatology in the psychic and somatic spheres was clearly recognized in her three cases, and deserves to be considered with a possible parallel of the alternations in asthma and eczema recognized by dermatologists in the eczema-asthma-hay fever complex. The personal characteristics of the subjects she studied accord with those of the literature in that they were ambitious, hyperactive, self-absorbed and mentally sensitive.

Wittkower's (80a) study of the allergic personality as illustrated by the hay fever patient also serves as a useful

guide-post to the study of personality in allergic cutaneous disease. The "nervous" temperament is commonly accepted as predisposing to hay fever and the diseases most common to the upper strata of society. Hysterics are uncommon among hay fever subjects. The patients belong to the active, brisk, energetic type of individual whose psychic organization is the antithesis of that normally appertaining to the phlegmatic type. Hay fever is frequently associated with a superior intellect, and with strong and active, and sometimes strongly emotional natures, capable of great endurance. Nickum (53), cited by Wittkower (80a), has noted that hay fever occurs in the type whose abnormally large output of energy and accelerated emotional and intellectual responses tend to situations in which are produced aggressive and painful affects that jeopardize their "sympathetic-autonomic balance." Kretschmer (41), quoted by Wittkower (80a), believes that individuals of a robust psychological structure hardly ever suffer from hay fever; probably also rarely, simple-minded persons. He believes that there is a high percentage of subtle-minded and mentally differentiated persons among sufferers from hay fever, and as a result, he emphasizes the frequency of psychasthenia rather than a general neurasthenia among them. Hay fever is almost always thus correlated to a parallel mental hypersensitiveness.

Wittkower's (80a) studies of fifty patients with hay fever and fifty controls (27 fractures, 23 acute appendices) showed that the behavior pattern of hay fever patients in general differs from that of the control group in a manner indicative of an inner disequilibrium, amounting to more or less pronounced disorders in character. The more outstanding character traits described were self-absorption, dreami-

ness, and ambition. A larger number of patients in the hay fever than in the control group exhibited gross neurotic symptoms seriously interfering with their social integration. He cautiously advances the opinion that the personality of the hay fever patient seems to fit in most easily with the Adlerian conception of neurotic character. Feelings of inferiority resulting in overweening ambition, and lack of community feeling with withdrawal and revery were found in many patients. More detailed researches, Wittkower (80a) believes, are needed to elucidate to what extent the type of personality frequently encountered in hay fever patients corresponds to the schizothymes of Kretschmer (41), the introverts of Jung, or the anal characters of the Freudian terminology.

An important feature of Wittkower's (80a) study was his comparison of the hay fever personality with that of allied allergic syndromes. He cites Stokes, Kulchar and Pillsbury (71) as describing the urticariogenic personality as follows: "The driving, high-tension competitive personality, keyed to high pitch and perpetually intent on destination, achieved at no matter what expense. Breakdowns and crashes, chronic neurasthenia, conflicts and adjustment problems, and a positive gift for worry are the nervous and mental expressions of the tension and instability that contribute to this disorder." Touraine and Draper (73) in a study of migraine emphasized an attitude of detachment and partial self-absorption in which the patients found it difficult to make social contacts. They were extremely sensitive to criticism and easily discouraged; assumed unnecessary burdens of responsibility, whether these were found in reality or in the fantasy world. Knopf (39) felt that her migraine patients were predominantly goody-goody self-righteous children, most of them shy,

sensitive, ambitious and bad mixers. Personal maladjustments and manifest neuroses were frequently found on examination. Wolff found more than half of his patients with migraine were delicate, or treated as such in childhood. They were shy and withdrawn. Courteous behavior was often associated in the same person with obstinacy. Nine-tenths of the subjects were unusually ambitious and occupied with the achievement of success. Conscientious, perfectionistic, persistent and exacting, they were constantly attempting to arrange or bring order wherever possible.

Wittkower points out that allergic and psychopathologic conditions have in common an over-reaction to stimulation. In both cases, a cause which is harmless for the healthy individual, in the neurasthenic any triviality, in the allergic patient the allergen, both innocuous for other individuals, produce comparable reactions of an explosive character. The reactions apparently occur in organs or organ systems predisposed by some inferiority. The connection posited between emotion and reaction in both conditions is the autonomic nervous system. The occurrence of character changes in later life as the result of eczema, prurigo and asthma, are recognized as possible secondary reactions.

#### THE ALLERGIC CHILD

The study of the childhood personality such as has been conducted notably by the Gillespie group at Guy's Hospital, Rogerson, Strauss and Draper (23*d*), has contributed substantially to the understanding of the personality background of the eczema-prurigo phase of the eczema-asthma-hay fever complex. The allergic child is so generally rated as above the average in intelligence, alertness, and sensitiveness that Balyeat's (3) statistical attempts to

demonstrate this and Piness, Miller and Sullivan's (58-2) opposing view deserve mention. The impression is certainly strong that the allergic child is above the average and Rogerson's most recent review (61) of his material tends to substantiate Balyeat's conclusions. Rogerson (61) found that the majority of a group of thirty children with asthma-prurigo, subjected to careful biographical, clinical and neuropsychiatric study, established clearly the intellectual superiority of the asthma-prurigo type. Of twenty-five children old enough to be tested upon the Binet scale, the average intelligence quotient was 108.8, while of a total of 321 other children in the same clinic tested during the same year by the same technic, the average intelligence quotient was 89. This result, Rogerson states, compares almost exactly with previous investigations upon the intelligence of children with asthma-prurigo. Dunbar (19) proposes as an alternate explanation conforming to Piness, Miller, and Sullivan's (58-2) observations, that the clinical impression of the superior intelligence of allergic children may result in part from the extreme emotional tension and ambition of these patients, together with the directness with which impulses to aggressive action break through into consciousness and tend to be carried out.

Rogerson's (60) really remarkable summary of the personality of the asthma-prurigo child can be borne out easily from the dermatological side. [*Cf.* Stokes (68)]. The majority of the children show abnormality of motor activity, being variously described as restless, overactive, high-strung (meaning usually, liable to sudden outbursts of movement). Many of the children described by parents and teachers in such terms appeared when first seen to be quiet and subdued. It was only later in watching them closely that an under-

lying restlessness could be observed. In many cases, as treatment progressed, the subdued or covertly restless child became boisterous and overactive. Twenty-one of the thirty children were described in various ways as being over-anxious, the over-anxiety being especially apparent in school work. In psychological tests many of the children showed so great a dislike of failure that they preferred to say nothing rather than to risk being wrong. Nineteen of the thirty cases were aggressive, irritable and dominating in their behavior, a trait which could be seen as related to the over-anxiety, since when there was fear of their not being able to excel others, their anxiety rapidly appeared. The majority of them showed an intense need to dominate their families and be the center of the picture. They would whine and cling to their mothers, appearing thoroughly over-anxious and insecure, but it was demonstrated again and again that the underlying motive was a demand for attention, rather than a fear of being left alone. The intellectual superiority of the majority has been mentioned. In the environmental difficulties which these cases present, a large number of the children were found to occupy a place in the family where they were particularly liable to be overprotected and excessively fussed. In a number of instances it was clear that parental over-anxiety was the cause of the personality picture presented by the child. The child clearly reflected the parental over-anxiety. A number of the children made use of the parental over-anxiety to gain personal ends. Rogerson (60) makes very clear the paradox of conflict which exists in the situation of the child who has finally made himself the center of the picture, completely dominating his family, and yet has, by that very act, paradoxically, completely lost his freedom. Under the inevitable restrictions

resulting from the parental over-anxiety, he becomes rapidly tense and irritable. Ackerman (23) in a study of a fourteen-year-old girl, with what appears to have been a prurigo, gives an extended description of the sex motif underlying the patient's dermatological condition, and her persistent orgies of scratching. The complexity of the situation is comparable to that described by Pearson in his analysis of two cases of skin excoriation.

The adult eczema personality (eczema-asthma-hay fever complex) has been described in some detail by Stokes, and accords in the main, with the descriptive elements brought forward by the previously quoted observers. Stokes (68b) directs attention to the ease with which the eczema personality becomes a prey to destinationism and to "the procession of musts," which exaggerate the inevitable tension features of modern life. Repressive discipline, the "don'ts" of the strenuous parent, the irritative or "electric" relationship, often with the parent of the same sex, and the development of the so-called "poker face" which renders the personality problem of the eczema individual particularly difficult of approach in adolescent and post-adolescent years, are stressed.

#### GUILT AND ANXIETY

These elements have been emphasized by students of the flush or blush dermatological condition. Stokes and Beerman (69a), dealing with the rosacea complex, mention the influence of slow-acting long-time psychogenic influences of the chronic wear and tear and worry description. A more detailed analysis led Klaber and Wittkower (36) to lay even greater stress on the emotional factors in the rosacea complex than did Stokes and Beerman (69a). They interpreted rosacea as a species of permanent blush

frequently, (36 of 50 patients) resulting from an abnormal degree of social anxiety, long antedating the onset of rosacea. This was based on feelings of inferiority, guilt and shame. Thirteen cases gave a history of acute psychological trauma immediately preceding the onset of the rosacea, and a further twenty cases had suffered from a preceding prolonged social or sexual stress. In one of their cases "week-end rosacea" directly connected with sexual repression and disappointment is described. The nature of the stresses was often such as to reactivate the emotional problems of the individual concerned. They believe the emotional state leads to the lowering of gastric tone to which they ascribe much of the physiological basis of the condition. They mention, however, Harmer and Harris's (28) observations on the similarity of the rosacea syndrome to that induced by the injection of histamine. The sense of guilt in the motivation of self-inflicted lesions is illustrated by one of Gillespie's cases, the pain relieving the qualms of conscience while the injury gave expression to the patient's aggressiveness.

#### ANGER

Mention has already been made of the so-called cholinergic urticarias excited by anger, and studied by Grant *et al.* (25) and by Hopkins *et al.* (31).

#### ESCAPE, ATTENTION, SYMPATHY

Both Rogerson (61) and Gillespie (23a) point out the use made by patients of abnormal psychological constitution, of skin lesions for the purpose of escaping intolerable situations. Just as the asthma attack may function as a symptomatic escape device, so it is conceivable (but we have been unable to find any adequate study) that the development of an eczema-prurigo may be purely on this basis. Gillespie (23b) de-

scribes a middle-aged spinster who used her eczema to obtain greater attention from her mother. Attention and sympathy of course play large roles in the characteristic factitial dermatoses, and Gillespie points out how carefully these patients should be differentiated from those who indulge in self-infliction purely for malingering purposes. The scratching bout in the eczema child is sometimes clearly an attention-getting device.

#### TENSION AND CONFLICT

The neurodermites, to which term several observers are now taking exception [including Gillespie (23b) and Sulzberger (72)] apparently operate as factors in a considerable range of dermatitides associated with supposed vagus-sympathetic imbalance. Stokes (68) has indicated in speaking of the eczema-prurigo mentality that the tension of this type of individual which can be recognized [Rogerson (61) also] even though apparently outward calm, is the product of over-conscientiousness and I-sensitiveness which engenders the sense of the obligatory in conflict with the more or less characteristic sense of inadequacy or inferiority of the type. Rogerson and his coworkers have emphasized the importance of the conflict between the urge to dominance and the inferiority-activated urge to dependence in the psychological state of the asthma-prurigo child. Gillespie (23b) describes excessive sweating resulting from a conflict between a woman's desire to escape from her marriage, and her ideal of duty. Pearson's (57) case of fungus infection of the feet associated with marked vasomotor and sweat reactivity, proved to have a fundamental conflict of a somewhat similar type which, when adjusted, led to the disappearance of the dermatosis. Stokes (68) in a general discussion of office psychotherapeutic technique, used a

series of common bases for conflict in which comparatively simple psychotherapeutic adjustment seemed materially to aid in recovery.

#### HYSTERIA

Säck's (64) summary in the Jadasohn Handbuch brings the subject of the hysterical dermatoses up to 1933. The hysterical background in dermatitis *artifecta* which is its principal field of action is critically discussed by Gillespie (23a). He emphasizes the diagnostic importance in identifying the hysterical factor in self-inflicted dermatoses of the appearance of hysterical paralyses which differentiates them from the more commonplace examples of malingering, attention-getting, and similar motivations. He believes that hysterics in general may not know why they produce signs and symptoms of illness, but that many of them are much more aware that they do produce them than is commonly realized. In a proportion of typical hysterical cases, therefore, the lesions are produced deliberately and consciously. The contention that the lesions are produced in a dissociated state so that the patient's amnesia for their production is automatic, is open to a good deal of question. Gillespie himself believes that dissociation is rare in dermatitis *artifecta*, and that most of the lesions are inflicted in full consciousness, only the motive being hidden from the patient. He feels, furthermore, that the amnesia itself in some cases is an artefact, or the result of self-deception afterwards; the patient lying in self-defense and then coming to believe his own tergiversation. The domination by a fixed idea may proceed to the point of permitting amputation, though amputation is not necessarily evidence that the basic process is hysterical, since it may belong to the group of compulsion neuroses.

Not only hysterical paralysis, but a variety of other hysterical accidents such as amblyopia and symptoms such as coxalgia, may appear in the life history of patients with hysterical artificial dermatoses. Stigmatization is fully reviewed by Klauder (38) with the results of his personal examination of Thérèse Neumann; in genuine stigmatization, the absence of inflammation and pus has been emphasized by a number of authors. Klauder agrees with Ewald (20) that there can be no question that Thérèse Neumann's lesions are not self-inflicted. Microscopic examination showed that the stigmas exuded blood, and that their appearance changed without any evidence of intervention during the course of the ecstasy. Gerlich (22) who also exhaustively studied Thérèse, challenged the diagnosis of hysteria and pointed to the occurrence of several injuries which had not been adequately examined or considered, and which he thought might be responsible for the neurogenic manifestations. Klauder (37) is apparently willing to go no further than to say that he believes the stigmatizations are genuine and not self-inflicted, though the mechanism still remains obscure. Gillespie's (23b) examination of the hysterical type of self-infliction led him also to include ecchymotic self-inflicted lesions with exhibitionistic tendencies among hysterical manifestations.

#### HYPOCHONDRIASIS AND INVOLUTION MELANCHOLIA

In these conditions there appear most commonly the results of preoccupation with the skin either as hypochondriasis itself, or as part of a hypochondriacal depression, as Gillespie points out. The effect of compulsive washing, not infrequently observed in older persons, especially women, may be uncontrollable without attention to the psychiatric side. The commoner parasitophobias are

also illustrations of hypochondriacal preoccupations with the skin in many instances, the condition extending sometimes from the original victim to other members of the family, who are literally infected with the notion of parasitism, and come in in a body to seek advice, bringing with them bottles, handkerchiefs, bits of paper, and so forth, containing foreign objects that they take to be parasites. Neuroses of the scalp in older women, including a conviction of hair-loss where none exists and abnormal preoccupation with slight dandruff, are also recognized, and local hyperhydrosis and local intractable pruritus are probably all parts of the same picture. Burning tongue, associated with fear of cancer, is one of the commonest and most disturbing of the mouth neuroses.

The so-called topalgias of Blocq (5), to which many of these instances belong, are common to the hypochondriacal type of personality (Klauder).

#### SEX AND EROTIC ELEMENTS

Current conceptions seem to link sexual and erotic elements with skin disturbances quite largely through the itch mechanism, whose erotic substitution values are generally appreciated. General pruritus occurring in conjunction with extensive dermatitis or eczema, or without gross objective accompaniment, has been described with attendant circumstances suggesting masochism and "cutaneous masturbation" by several authors including Stokes (67*d*). Klauder (37) on various occasions has expressed the belief that these connections are over-emphasized. Rogerson's (61) recent review, however, cites in detail Cormia and Slight's (10) case which seems inescapably one of scratch substitution in an unsatisfactory sexual relationship. Gillespie (23*b*) cites a case of a general prurigo with cutaneous masturbation accompaniment. The sex-

ual significance of the genital and anal pruritides is clearer and more generally accepted than that of more dispersed itching phenomena. Hunt (32), in analyzing 300 cases of pruritus vulvae, felt that only eight presented incontestable evidence that the psychogenous cause was primary or sole, though in many others a psychogenous factor could be recognized. Rogerson (61), in discussing the sexual background of pruritus vulvae, emphasizes that it may occur in married quite as often as single women; that it may be an expression of sexual tension, and it may equally be utilized as a method for avoiding normal intercourse which is made impossible through excoriation. A case of Gillespie's (23*b*) of a single woman, age 38, illustrates the succession of needless operative and other intervention to which the sexually grounded pruritus vulvae may be subjected. Symptoms disappeared when she was released from parental domination, especially maternal, and her anxiety about her sexual history was relieved. Kreis (40) reports four cases of pruritus vulvae successfully treated by psychoanalysis.

Pruritus ani seems to offer a more tempting field for psychosomatic explanations even than pruritus vulvae. Gillespie's (23*b*) case illustrated a variant on the typical picture, in that a middle-aged bachelor who displayed his buttocks with exhibitionistic enthusiasm on all occasions, found relief for his perianal irritation by scratching the right buttock. Gillespie (23*b*) points out that giving anal anesthetics to children may encourage what is almost a normal anal eroticism in the early years of life. He also points out that the physical lesion produced by the trauma of scratching, namely lichenification, requires not only surgical or other treatment for the removal of the physical condition of lichenification but treatment of the sexual neurosis underlying

the pruritus. Rogerson points out that pruritus ani may also give a clue to the existence of unsatisfied homosexual desires, and that the use of local applications may in such cases prove harmful rather than beneficial. Stokes (68b) in a discussion of the treatment of pruritus ani integrates the anal fixation mechanism and anal eroticism with a number of other factors in refractory cases of pruritus ani. One of his cases illustrates the concomitant occurrence of itching and lichenification of the posterior scrotal wall as an expression of sexual tension in the male.

Urticaria, as a manifestation of sexual tension and conflict, is conventionally illustrated by cases of outbursts of urticaria at the time of coitus. Dunbar (18) describes an interesting variant on urticariosexual relations in the form of a patient who spontaneously developed urticaria as a method of compromise, so to speak, between the desire of her sadistic partner to raise welts on her with a belt, and her feeling that she should dismiss him though she ardently desired to retain his attentions. By raising her own "welts" she retained her partner and avoided the beatings.

Tattoo is rated by Klauder (37) as primarily an expression of adventurousness, a spirit of emulation and an imitative instinct. He cites Parry, however, as holding quite contrary views in that Parry believes the basis of tattooing is sexual and represents the recording of suppressed shrinking with an element of masochism and exhibitionism.

Gillespie (23b), in his general discussion of pruritus makes a significant correlation between the worrying depressive type of personality which expresses uneasiness of mind by uneasiness of skin (itching) with associated scratching. He says, "The skin is chosen as a means of expressing anxiety of a general kind; although it is possible

that it is so chosen because scratching acts as a temporary means of allaying the physical uneasiness produced by uneasiness of mind—*just as some people take to masturbating when they are worried.*" This suggested relationship probably has an important bearing on the cutaneous masturbation activities of the EAHF type of person as brought out by Stokes (68b4).

#### PARENT-CHILD RELATIONSHIPS

The parent-child relationships so important in general psychiatry are also of great importance in skin conditions with psychoneurogenous backgrounds. Rogerson (60) has delineated with particular care the parent-child relationship of the eczema-asthma-hay fever complex. He emphasizes particularly the disposition of the child if born into an unadjusted or difficult family life, to dominate the parent while at the same time seeking an over-dependence which is fundamentally in conflict with the aggressive emotion. While recognizing the importance of first, second and third child positions in the family; of unwanted and over-wanted children; of compensatory over-affection and over-protection on the part of the maritally unsatisfied parent; Rogerson (60) points out that the dominance-over-dependence conflict or combination develops in children who are brought up in comparatively normal families. This, of course, suggests that this type of reaction is part of a mental warp, trend or predetermined pattern rather than of environmental circumstances. Numerous illustrations are available of the utilization by the child of its physical (*i.e.*, cutaneous) symptomatology to gain attention, and dominate the situation, and so forth. Rogerson (60) emphasizes that adequate psychotherapeutic management of these EAHF children requires at least as much attention to the parent as to the child. The

parent must be led away from the attitude of over-anxiety and the various compensating mechanisms incident to his own psychological problems, and induced to give the child his chance. Stokes (68b-4) confirms these observations, and notes the tension relationship between the EAHF subject and the parent or other closely attached individual, usually of the same sex. In such a relationship, resentment on the part of the dominated parent or other adult is in curious conflict with over-affection and over-anxiety. Rogerson (60) analyzes out this status of the child in the family, often sufficient to account entirely for the parent's attitude, as including instances of 1) only surviving child; 2) child born soon after marriage; before close inter-parental relationships have had time to develop; 3) child result of forced marriage; 4) the unwanted child. In the last-mentioned, the parent, overcome by a sense of guilt for not desiring the child, endeavors to compensate with over-affection and excessive solicitude. Individual case instances of the parent-child relationship occur in a variety of the vasomotor dermatoses especially. Klaber and Wittkower (36) cite a combination of strong loyalty to the mother and deep resentment against her, leading to death wishes and a sense of guilt which underlay the severe rosacea that the patient developed. Over-attachment to the father and repressed aggression are also cited in the background of the rosacea complex. Gillespie (23b) cites an illustration of a patient with an infection of the hands, in which the adjustment of an unsatisfactory relationship between the young man and his father resulted in the permanent cure of the skin fungus infection, after dermatological measures had failed. Similarly Pearson (57) found in one case that fear of the mother and the husband was the underlying factor in

vasomotor and sweat disturbance in the feet accompanied by a severe dermatophytosis, in which dermatological treatment thoroughly carried out had failed, but psychological management resulted in cure. Two other of Pearson's cases (57), both of excoriation, showed complicated relationships to fear and resentment against the father, in one case, and the father and step-mother in the other. Here, again, masturbation and skin excoriation were linked in a regressive mechanism. Ackerman's (1) analysis of the personality factor in a case of neurodermitis, showed the varying parental relationship in chronological periods in the patient's life.

Review of the literature, and of his own experience, brings the would-be dermatoneuropsychiatrist to its close with mixed feelings. The material which he handled and the reviews that best illustrate the direct physiologic linkages of the psychosomatic sphere appeals to him. He has little difficulty, comparatively speaking, in connecting obvious vasomotor and sweat phenomena with states of mind. On the other hand, as the complexity of the psychiatrically presented phase of the psychosomatic material increases, the dermatologist, like no doubt many other medical specialists, finds himself at first confused, and finally incredulous. This is the end reaction against which all concerned with psychosomatic problems should be most on their guard. It is an emotional reaction fundamentally, easily enough recognized at times as a thalamic rush of anger and indignation that a dermatologist should be asked to believe such "rot" as the psychoanalyst appears to be offering as etiology for obvious straight-forward visible dermatoses. What shall the dermatologist do in such a situation? He shall place himself doubly on his guard against the natural but improper disposition to refuse credence to that which he does not

understand. He should recognize that other specialties besides his own have their intricate observational criteria, as objective and valid in their way as are his own. He should view with suspended judgment or an expression of perhaps admiring astonishment, the prestidigitation in words and ideas of some of his psychiatric fellow-workers. Only by the maintenance of a serenely detached, neither accepting nor rejecting attitude of mind will he be able in all fields of psychosomatic correlation as it touches dermatology and allergy, to avoid the role of an obstructionist and to advance the cause by tolerance, if he cannot supply critical understanding and unqualified acceptance.

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## A CRITICAL EXAMINATION OF THE CONCEPT OF BISEXUALITY\*

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### HISTORICAL SURVEY

MAN AND WOMAN were once a single being. This entity was cut in two by an angry god, and ever since the halves have reached toward one another in love, out of a longing to restore their original state. So the story runs in Plato's "Banquet." Traces of it have been found, however, in older sources including the Upanishads and the Old Testament, proving that Plato's fanciful conception was based upon a far more ancient myth (4, 18, 19).

This myth represents one of man's earliest intellectual approaches to the puzzle of the existence of two sexes. It offers a simple solution to this problem by creating an opposite concept, that is, the idea that man was formerly bisexual. To the primitive mind, however, this means that he still is. Consequently the myth is curiously equivocal, and manages to convey the exact opposite of the fact that it so ingeniously explains. It is as if the myth read: "I will tell you why there are two sexes. The truth is that they are one. Properly speaking we are all bisexual."

It is clear that ancient man must have had strong motives for denying the differences between the sexes. He may have found support for his comforting solution in the occurrence of hermaphrodites. The two other ele-

ments of the myth are traceable to simple and profound human experiences. The image of violent separation is reminiscent of the event of childbirth, culminating in the cutting of the umbilical cord, while the concluding idea of a partial reunion brings to mind the pattern of the mother holding the child in her arms.

The conception of bisexuality was sanctioned by religious authority. Embodied in a system of belief, the idea had the power to eclipse the facts. Certain Egyptian gods were notoriously bisexual and Hermaphroditus, a favorite Greek god and highly popular subject for painting and sculpture, still carried an implication of deity in the Roman Empire. The advent of Christianity wiped out the religious significance of this foremost symbol of bisexuality, but the idea itself remained, to be revived in less spectacular form throughout the ages. Nor was its diffusion by any means limited to cultures touched by the heritage of the classical world. Anthropologists have found it to play a vital rôle in the cults, customs and folklore of primitive societies of our time, the Dutch Catholic missionary and anthropologist, J. Winthuis, even making it the title and central theme of his book "Das Zweigeschlechterwesen" (18). To what can we attribute the extraordinary range and tenacity of this myth? This question, involving as it does the history of civilization, obviously reaches beyond the province of psychoanalysis. We have, however, an

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experimental approach to the problem. Through the analytic study of children and neurotics we are familiar with the emotional conflicts associated with the discovery of the differences between the sexes. (Since many of these reactions are elementary, it is reasonable to assume that they are also ubiquitous and that they are a part of the aboriginal matter from which the concept of bisexuality has arisen.)

These scanty references may suffice to show that the idea of bisexuality far antedates the scientific era and owes its origin to primeval, emotional needs of animistic man. It is important to bear this in mind in our examination of the part played by the same concept in modern science.

In about the middle of the 19th century it was discovered that the urogenital systems of the two sexes derive from a common embryonic origin. The question of whether this *uranlage* should be considered neutral or hermaphroditic was at first a subject of debate. When it was found to contain cellular material of both gonads (Wittich, 1853; Waldeyer, 1870) it was definitely labeled hermaphroditic (16). This unfortunate appellation of an undeveloped embryonic structure marked an historical turning point, as it opened the door to indiscriminate speculations on man's bisexuality. These speculations, resting on generalizations drawn from biological findings in lower animals, seemed to offer at last what appeared to be a scientific basis for the explanation of homosexuality and it was because of medical interest in this subject that the concept of bisexuality found its way into psychiatry. The first attempts in this direction were made by Kiernan (1884, 1888), Frank Lydston (1889, 1892), and the Frenchman Chevalier (1893). The writings of these men stimulated the Viennese psychiatrist v. Krafft-Ebing to expound the

neuropsychological aspects of bisexuality in the following theory: since the peripheral part of the sexual apparatus is of bisexual predisposition, this must be true of the central part as well.

Thus (one must assume that the cerebrum contains male and female centers whose antagonistic action and relative strength determine the individual's sex behavior. Homosexuality results from the victory of the wrong center. v. Krafft-Ebing realized that hermaphroditic developmental abnormalities of the genitals and homosexuality are rarely associated. So he went on to the further assumption that the central part of the sex system is autonomous and therefore independently subject to developmental disturbances. Not a trace of neurological evidence was then or is now available to give credence to v. Krafft-Ebing's chain of hypotheses.

From 1896 on v. Krafft-Ebing's views on bisexuality were included in his "*Psychopathia Sexualis*" and thus gave the first impetus to the vogue which the concept has enjoyed even to the present time (15). Two other writers during the 1890's also contributed to its popularity: Havelock Ellis embraced the idea in his eclectic tenets, and Magnus Hirschfeld, who engaged in a lifelong defense of homosexuals against the harshness of a mediaeval law, became a devoted partisan of the concept of bisexuality (3, 9). The latter gave a new slant to the subject implicit in his view of homosexuality as an in-born characteristic brought about by a specific proportion of male and female substances in the hereditary composition of the brain. This version places the burden of proof primarily on the shoulders of geneticists, who, however, have not yet fulfilled this obligation.

In 1905 Freud published his "*Contributions to the Theory of Sex*" (5). Here he followed the lead of v. Krafft-Ebing in applying the notion of bisexuality to

the central as well as to the peripheral part of the sex apparatus. However, he was aware of the futility of ascribing to the brain hypothetical properties and functions not yet ascertainable by neurological research, and claimed that the central manifestations of sex, *i.e.*, psychosexuality, must be studied by psychological means. This was in line with his general attitude in regard to all the psychologically accessible functions of the brain and it was precisely for this purpose that he had evolved the method of psychoanalysis. In the desire to remain free and unbiased in the evaluation of his findings, Freud intentionally kept himself apart from the other medical sciences. He was obliged however to use as points of orientation a few of the basic assumptions of biology, and it was as one of these that he introduced into psychoanalysis the concept of bisexuality. This borrowed concept, formulated as a general characteristic of every human individual, came to play so important a rôle in psychoanalytic theory that younger men in the field dealt with it, not as a postulate or convenient frame of reference for interpretation, but as an established fact. Freud himself had no pretensions on this score: as recently as 1933 he reiterated that he had merely "carried over the notion of bisexuality into mental life" (6); (he spoke significantly of "constitutional bisexuality," and as he of course always maintained that constitutional factors were beyond the reach of psychoanalytic investigation, the phrase explicitly disclaims for psychoanalysis all responsibility as to the validity of the assumption.) Psychological data alone have never been, and could not be, conclusive in this respect. If the hypothesis were abandoned in the field of biology from which it had been taken, the data accumulated by psychoanalysis would have to be reinterpreted. In any case verification

rested, and quite rightly, with biology.

This state of affairs is somewhat disconcerting to a psychoanalyst, as grave doubts have arisen as to the psychological value of this concept, doubts substantiated by certain observations made in its application to medical practice. The analyst therefore has an urgent theoretical and practical motive to seek clarification of this subject, and for this he must turn to a field other than his own.

#### SEX AND BISEXUALITY IN CONTEMPORARY BIOLOGY

We shall now glance briefly at the actual status of the idea of bisexuality in the biological field (19, 1, 14, 2, 17, 7, 8, 11). What has happened to this idea since its first appearance as a scientific generalization? On examination one finds that a truly enormous amount of relevant data has been assembled, leading to new formulations and terminology, and that as a result the old speculative notion of bisexuality is in the process of withering away. These developments are due not only to the greater body of available facts, but also to an increasingly scientific attitude, less animistic, dedicated to a finer logical precision, and coinciding with a definite shift of emphasis from the morphological to the functional point of view. This trend is clearly indicated by Frank R. Lillie in the following passages (10):

"There is no such biological entity as sex. (What exists in nature is a dimorphism within species into male and female individuals, which differ in respect to contrasting characters; it is merely a name for our total impression of the differences.) It is difficult to divest ourselves of the pre-scientific anthropomorphism which assigned phenomena to the control of personal agencies, and we have been particularly slow in the field of the scientific study of sex char-

acteristics in divesting ourselves not only of the terminology but also of the influence of such ideas. . . . (Sex of the gametes and sex in bodily structure or expression are two radically different things.) The failure to recognize this elementary principle is responsible for much unsound generalization."

From the biologist we learn that sex in the gametes refers to their differentiation in form and function relevant to their reciprocal action of fertilization. In the somata, carriers of the gametes, sex refers to their differentiation in form and function relevant to or associated with 1) their reciprocal action of ensuring proper functioning of the gametes, and 2) the development of the embryo, giving birth to and caring for the child. If we put these two references together, we see that (sex in its entirety refers to the differentiation in the individuals as regards their contrarelated action systems of reproduction.) Taking these considerations now in reverse order, we start from the fact that in so far as concerns their reproductive action systems, individuals are of two contrarelated types. It is precisely this differentiation that constitutes the character of the sexes. Each of the two systems may be dissected into a multitude of structures, substances and functions, of which it is composed. The sex aspect of every one of these constituent parts is derived from the fact of its participation in the system as a whole.

From this definition of sex it follows that it is not permissible to single out any one element no matter how conspicuous, such as the gonad, and make it the sole criterion of sex. To attempt to determine "maleness" or "femaleness" by the relative percentage of male and female hormones in blood or urine is obviously to carry this error to an extreme. Sex can be determined only by the character of the reproductive action

system *as a whole*.) The human being is not a bundle of cells or tissues but a complex biological system, in which new system properties appear on every hierarchic level of integration. And sex is not a small bundle of cells and tissues within a larger one, but a component system of the total system: the individual. The relative significance of the various elements in each of the two sex systems has still to be established. The usual distinction between primary, accessory and secondary sex characteristics is one-sided and inconsistent, and misleading when applied in medical practice. This is a problem to be approached from different theoretical and practical angles and to which there is accordingly more than one solution.

Reproductive activity of course presupposes reproductive maturity. (What then is sex, in terms of this biological conception, in the infant, the embryo, the zygote? The answer is obvious: differential development, directed toward the construction and perfection of the reproductive system.) At this point, however, the picture becomes more complicated. Biologists today agree in the assumption that every zygote has the intrinsic capacity to give rise to an individual with either a male or a female reproductive system. The developmental process is shunted into one or the other direction by the successive action of determining factors such as genes and endocrine substances. It may even happen, as demonstrated in animal experiments, that the initial direction is reversed by the action of a later determinant. Also important is the fact that although by its gene composition the zygote is already earmarked for one sex, the traceable developmental process is at first identical for both sexes; and even when visible differentiation begins there may still appear two sets of discrete primordia for some parts of the genital apparatus,

as if a choice of direction still remained. Thereafter, one set of primordia develops further while the other degenerates, regresses, or remains in a rudimentary state.) In accord with these facts the zygote as well as the early embryonic stages are no longer referred to as bisexual, but are said, more accurately, to possess bipotentiality of differentiation. Under normal developmental conditions, as differentiation proceeds and one type of reproductive action system grows to completion, the original bipotentiality ceases to have any real significance. It is true that in some classes of mollusks, such as oysters, certain gastropoda and pteropoda, every individual has as standard equipment two complete reproductive systems, one male, one female, and actually engages in fertilization in both ways. The individuals of these species are truly hermaphroditic, *i.e.*, bisexual in the only legitimate sense of this term. However, from the existence of species so organized nothing whatsoever may be deduced in regard to the organization of the human species or of the higher vertebrates in general. The standard developmental pattern of our species provides for each individual only one reproductive action system. The two inherent potentialities of the zygote are thereby mutually exclusive.

In humans the complicated embryological past of the reproductive system has no detectable influence on the efficient reproductive functioning of the normal individual. It can, however, play a part in disturbances of embryonic development or later in the life cycle. Embryonic differentiation of the reproductive system may be hampered by abnormally changed genes or hormonal or other factors, which foster a rival development on the part of the contrasting set of discrete primordia. The stimulation of tissues which produce hormones of the opposite sex is an

important element in these disturbances. The result is anatomic malformation ranging from a marginal inconsistency in the ultimate differentiation of the sex system to a bizarre fusion and confusion of parts and characteristics of both systems. In such individuals the capacity of reproductive functioning is often hindered or lacking; they are sexually crippled, but obviously not bisexual. Derangement of a normally built sex system in later life may be observed in the female. Certain tumors of the ovarian medulla, of the adrenal cortex or of the pituitary entail an excessive output of male sex hormones that rouse the male embryonic rudiments to belated developmental activities. As in the case of embryonic malformations, this conflicting growth impedes or destroys one form of reproductive functioning while creating no new capacity to function in the opposite way. Similar changes can also be brought about artificially in animal experiments in so-called sex reversal. With or without removal of the animal's own sex hormone-producing tissues, hormones of the opposite sex are injected at various stages of embryonic development or later. Although in mammalia this has resulted only in the derangement of the established sex system, in lower species complete and successful reversal has been obtained. Partial reversal means that the individual is sexually incapacitated; in complete reversal the sex is changed but there is still only one.

To sum up this biological survey: using the term bisexuality in the only sense in which it is biologically legitimate, there is no such thing as bisexuality either in man or in any other of the higher vertebrates. In the final shaping of the normal individual, the double embryological origin of the genital system does not result in any physiological duality of reproductive func-

tioning.) This double origin is of significance only in developmental disturbances and reversals resulting in an admixture of structural characteristics of the opposite sex and thus recognizable as inconsistencies of sex differentiation. In such abnormally built individuals reproductive activity may be impaired or impossible, but the presence in their genital structure of fragments of the opposite sex does not confer upon them the reproductive capacity of that sex.

#### THE PROBLEM IN PSYCHOANALYSIS

Reverting to the psychological study of reproductive activity we are at once struck by the element of pleasure, a feature that necessarily eludes the physical methods of the biologist and which seems at first to lead us into another world. Must we now abandon the dictum of biology, that sex is a matter of the reproductive action system? Let us glance briefly at the decisive psychological facts. It is man's practice to engage in genital activity regardless of reproductive intent. He may even abandon any possibility of reproduction by evading in this pursuit the genital organ of the opposite sex. But how then is the pleasure yield of genital activity obtained? What is its nature? It is, of course, orgasm, a reflex effect of the reproductive action system. (Having so identified genital pleasure, we see that it is precisely the orgasm element of the reproductive system that forms the basis of the genital pleasure function. Orgasm is a pivotal point, being also the point of insemination.) Considering the enormous variety of man's sex practices it seems at first incredible, but on second thought quite natural, that they can all be reduced to a simple formula: in deviating from the standard pattern of genital activity man derives excitation from stimulating the sensitive spots

available in his mind and body; he may even be driven to seek excitation by dramatizing himself in terms of the opposite sex; yet all this preparatory excitation culminates in genital excitation and is discharged by way of the orgasm reflex. To repeat: (the common denominator in all clinical pictures of genital psychopathology is that they represent abnormal conditions of stimulation; yet all the stimulation derived from whatever sources, and by whatever means, acts upon a single physiological pleasure-effector, the orgasm reflex.) This reflex partakes of the differentiation of the two reproductive action systems, for it involves different anatomic structures and performs different mechanical duties in each. Physiologically, genital pleasure activity in an individual with male organs is always male, and the same applies to the female. (Whatever man does or fancies, it is just as impossible for him to get out of the confines of his biological sex as to get out of his skin. At this point there of course arises the question of the extra-genital pleasure functions, discovered and explored by psychoanalysis: oral, anal, tactile, etc. These are rooted not in the reproductive system but in the alimentary or some other basic biological system. They interact and combine with one another and with the genital pleasure function to make up the individual's entire *pleasure organization*.) The latter is obviously neither sexual nor non-sexual, but an entity of a new order, brought about by integration on a higher level. It undergoes typical changes during the life cycle and is characterized at every stage by a measure of functional flexibility, working in the service of one and then another of the underlying biological systems. If pathologically disturbed it of course hampers rather than benefits the utility function of the system in-

volved. This pleasure organization requires a term that reflects its biological nature and avoids confusion between the superior entity and its component parts. The identification of pleasure and sex made by classical psychoanalysis is at any rate biologically untenable; though originally a dynamic source of inspiration and unparalleled in popular appeal, it led eventually to hopeless confusion and doomed the psychoanalytic study of sex to scientific frustration.

Thus the biological status of the genital pleasure function, heretofore wrapped in ambiguities, is definitely established: inseparable from the reproductive action system, it is also integrated on a higher level into the pleasure organization in the individual.

This clarification was a prerequisite to any examination of the use that has been made of the concept of bisexuality in psychoanalysis. Essentially the procedure has been as follows: (Certain types of behavior, or attitudes, or even mere phantasies have been interpreted in the male as "feminine," and analogously with the female, and taken as manifestations of the individual's "negative Oedipus complex" or "homosexual component." Such a component has been assumed, on the basis of the concept of bisexuality, to be present in every individual.) It is not pleasant to have to admit that a closer scrutiny reveals no less than six major flaws in this procedure.

1) The designation of masculine or feminine can be made with reasonable certainty only in the case of a relatively small group of phantasies referring either to the individual's possession of one or the other type of genital equipment, or to impregnation, pregnancy or childbirth. Where no possession or reproductive use of genital equipment is implied, as is the case in the vast majority of phantasies, attitudes and

types of behavior, such a designation, though perpetuated by convention and routine, has rested on purely arbitrary grounds.) Freud was always aware of this stumbling-block and in 1905 suggested as the psychological definition of male or female the pursuit of active or passive goals. However in 1933 he was forced to retract this suggestion and to admit the futility of any such attempt (5, 6).

2) In diagnosing psychic manifestations as masculine or feminine no distinction has been made between adults and the youngest children, in total disregard of the differences in information and intellectual maturity. A phantasy whose content is unquestionably male or female in an adult, might in a child reflect nothing but complete ignorance or deliberate misinformation.) The inheritance of knowledge and ideas, first envisaged by Plato and lately revived in psychoanalysis, must obviously be left out of consideration in the absence of any factual basis for such a claim.

3) Equally unwarranted is the idea that these so-called masculine and feminine manifestations are the direct expression of a constitutional component of the opposite sex. It is well known that phantasies draw their content from experience and therefore to a large extent reflect environmental influences, but this has been lost sight of in the field of sex. (A phantasy, even though influential in attitude or behavior, may or may not be the expression of a particular constitutional component.) Inspired by birds, man has dreamed for millennia of flying under his own power, but no one has ever suggested that this implied a flying component or predisposition in his constitution.) It is also noteworthy that pure phantasies devoid of any driving force and behavior indicative of a strong motor urge have been con-

sidered equally representative of a constitutional component.

4) The constitutional component itself has been a subject of further ambiguity and error. In general theoretical formulations as well as in practice it is indiscriminately referred to either as a homosexual component, or as the female component in the male and the male component in the female. This is all the more remarkable as it is a matter of general knowledge that in some forms of homosexuality behavior is in no way related to the behavior pattern of the opposite sex. Obviously no knowledge is immune to the truly narcotic effect of an appealing generalization.

5) Even aside from this confusion, the term homosexual has been so stretched as to become almost meaningless. Any relationships between two individuals of the same sex, domination, submission, competitive struggle or friendly cooperation, have readily been interpreted as manifestations of "unconscious homosexuality," regardless of whether or not they have any conscious or unconscious bearing on the patient's sexual life. We have already seen the inconsistency and inaccuracy of the term sex as used in psychoanalysis; the term homosexuality has been even more grossly misapplied.

6) The assumption of a "homosexual" or "opposite sex" component in the constitution has not served as a challenge to discover what such a component might actually consist of, and in what specific ways, if at all, it influences man's sexual behavior. On the contrary, it has been relied on as if it were the outcome of research which in reality has never been made or even attempted.

It should now be apparent that the vague notion of biological bisexuality, and the incredibly loose manner in which it has been used in psychoanaly-

sis have had deplorable consequences. It has acted like a will-o'-the-wisp, always and everywhere luring our attention so that it was impossible to see where the real problem lay. And it has gravely detracted from the benefits to be derived from the unique method of research possessed by psychoanalysis. This could not but have the effect of lowering our therapeutic efficiency. The idea that he is up against a homosexual component in his constitution has often produced in a patient needless discouragement or panic, if not more serious complications.

Free from the preconception of bisexuality, we must of course take new and more reliable bearings in the field of genital psychopathology. The position outlined above on biological grounds then inevitably becomes our point of departure. (The basic problem, to state it briefly, is to determine the factors that cause the individual to apply aberrant forms of stimulation to his standard genital equipment. Following up this line of inquiry, we find that the chief causal factor is the affect of anxiety, which inhibits standard stimulation and compels the "ego action system in the individual" to bring forth an altered scheme of stimulation as a "reparative adjustment" (12, 13). Both the inhibitory and the reparative processes begin far back in early childhood, leading up to the picture which we encounter in the adult. The reparative adjustment may allow the individual several alternatives of morbid stimulation, or may take the form of a rigid and inexorable pattern on which he depends for gratification.) This approach, of which we can give here only the barest suggestion, has in practice unfolded a wealth of clinical details leading to a theory that is free of inconsistency and that serves as a reliable guide to treatment.

It also demands a change in outlook

toward the underlying problem of constitution. If we assume, as we must, that constitutional factors may have an influence on morbid sex developments, we are now justified in considering this influence to be of two kinds: one preparing the ground for the inhibitory action of anxiety, the other modulating the course of the reparative adjustment. In considering the factors so involved we must not overlook the possibility of general, *i.e.*, non-sexual factors, as well as innate defects of the sexual action system of as yet unknown character. It is well to recall, lest we underestimate this eventuality, that we are still in the dark even as regards the physiological mechanism of such an elementary phenomenon as sexual attraction. Still another possibility is of course the presence of elements of the action system of the opposite sex such as reflexes, or rather chains of reflexes, susceptible to resuscitation by hormones or other agents (20). However, not until somatic research has disclosed such elements shall we be able to determine by psychological methods their rôle in shaping morbid sex behavior. Meanwhile unbiased psychological analysis can offer invaluable clues to the somatic investigator in his search for predisposing somatic factors. Any such contribution was obviously out of the question as long as we employed fictitious constitutional factors as a means of psychological explanation. This methodological error not only trapped us in a vicious circle, but also deprived somatic research of a lead not obtainable elsewhere.

In conclusion it is imperative to supplant the deceptive concept of bisexuality with a psychological theory

based on firmer biological foundations. Reconstructive work of this nature is more than an invitation; it is a scientific obligation for psychoanalysis. It is also an obligation to the founder of our science, Sigmund Freud, who left us not a creed but an instrument of research.

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## AN ANALYZED CASE OF ESSENTIAL HYPERTENSION\*

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### INTRODUCTION

IT IS COMMON knowledge in the medical profession that acute emotional tensions have an influence upon the height of blood pressure. Franz Alexander pointed out in his paper "A Psychoanalytic Study of a Case of Essential Hypertension" (reported in *PSYCHOSOMATIC MEDICINE*, Vol. I, No. 1, January 1939) that, in the research cases investigated at the Chicago Institute for Psychoanalysis, the psychoanalytic study and therapy of such patients showed, in the first place, that the psychological observations obtained by the method of psychoanalytic technique promised a more intimate insight concerning the influence upon the blood pressure not only of acute emotional states but also of chronic emotional tensions as they can be observed in neurotics. Also, that the psychoanalytic study of cases gives a detailed picture of the personality development from early childhood, which may throw light upon the development of the hypertensive state. Finally, that a comparative study of a series of patients suffering from essential hypertension may answer the question as to whether or not there is a definite personality structure which is characteristic for these patients.

In the presentation of this case (which is included in the research series of the Institute for Psychoanalysis in Chicago and which had been controlled by Dr. Thomas French of the Institute), an attempt will be made to give

a dynamic picture of the personality make-up of this hypertensive patient and to determine whether or not there were definite emotional tensions which had a specific influence upon his blood pressure.

Of further interest academically is the determination as to the rôle which the emotions can play in certain cases of essential hypertension and whether or not these emotions are of etiological importance. It has been known, even by the laity, that anger is an emotion connected with high blood pressure, an impression which is confirmed by scientific investigation.

E. Weiss has pointed out the relationship between acute emotional tensions which influence the height of blood pressure. It is frequently observed that the patient who is apprehensive while having his blood pressure taken shows lower ratings after he has been reassured.

Walter Cannon has recorded his observations in animal experimentation, corroborating these clinical findings and showing that, under the influence of rage and fear, the blood pressure rises. It is interesting to speculate as to the effect of chronic rage, which has been repressed over a long period of time, upon the blood pressure. Another important clinical observation, which has been described in the literature, is that most essential hypertensive patients show marked neurotic personality traits. Analysis, tracing the emotional development of the individual, may not be able to answer definitely the question as to whether or not

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the neurotically disturbed emotional life and high blood pressure may be parallel manifestations of a third factor which may be constitutional, or whether the hypertension may contribute to the development of the neurotic tendencies. However, in a sufficient number of cases of essential hypertension who show, in psychoanalysis, certain common etiologies, it has been found that these conflicts have shed some light as to the probability that the hypertensive state may be the result of a long-standing neurosis.

#### THE PATIENT'S PERSONALITY AND ITS DEVELOPMENT

The following observations were made during the analysis of a male patient whom we shall call "Mr. X." This patient suffered from a pronounced hypertension of the fluctuating variety. The systolic blood pressure fluctuated between 200 and 140, while the diastolic varied between 130 and 80. When he first came for analysis, he was 41 years of age. He was a Catholic. In appearance, he was attractive, masculine and virile, over 6'1" tall, always neatly dressed, the successful business man type. He gave the impression of having a good deal of energy and of being dynamic and restless.

Preceding this patient's analysis, his wife had been under my care for over a year, for symptoms of anxiety, fear of heart attack, precordial distress, insomnia, and lack of response to her husband sexually.

There were two children for whom the patient exhibited a great deal of concern on account of the thyroid deficiency of his older, fourteen-year old son, and because his four-year-old son suffered from undescended testes.

The patient was one of seven children, the third in the line of siblings. In presenting the family history, he stated that his father had died of a

cerebral vascular accident and of nephritis at the age of 57, that he had been alcoholic, and that he was a very large man, weighing over 260 lbs. The father had been an individual for whom the patient recalled having a good deal of fear. The mother was described as being a very irritable, irascible woman, domineering, who had been married three times; she died at the age of 56, four years prior to the patient's analysis, of a chronic kidney infection and diabetes. The patient had two brothers and two sisters living and well. One brother died of Bright's disease, another brother died of a brain tumor, and a third brother has been studied neurologically and treated at the Mayo Clinic for a condition resembling myasthenia gravis.

The patient has been eminently successful in the business field, due to his great energy "drive" and initiative.

Previous to analysis, the patient had found it necessary to limit his use of alcohol, because of palpitation and precordial distress from which he suffered; he had also been forced to limit his exercise and lived in constant fear of his heart "missing beats" as he reported it. He would have severe anxiety attacks at night and would wake up in cold perspiration, with his heart beating rapidly. He said he could tell that his blood pressure was high "by the pounding sensation" in his head and neck. He became frightened because of extrasystoles. At times these symptoms would be accompanied by vomiting which, occasionally was self-induced as it seemed to offer him relief. He would become so frightened as a result of his symptoms that he would frequently call his physician during the night. He was referred to me by his physician who had observed him in these attacks over a period of time. The following is a copy of the physical

examination made by his referring physician:

He complained of nervousness, high blood pressure and a feeling of being tired. He had been on a trip the previous week and had felt extremely tired, had a feeling of distress in his chest and his blood pressure was found to be 180/80. The physician whom he had consulted on this trip had seen him at his hotel on a number of occasions because of palpitation and attacks of cardiac distress. He obtained relief by inducing vomiting. It was apparent that he was under considerable nervous strain in his work and at home. Great difficulty was experienced in persuading him that he did not have heart trouble. Past history revealed that he had had two operations for hemorrhoids and rectal abscess. He had had chronic constipation, also a condition diagnosed as spastic colon. He also gave a history of having a severe attack of pneumonia in 1918.

General physical examination revealed little, physically or neurologically, that was significant. Tonsils had been removed, there were several crowns in his teeth. Blood pressure after he had quieted down was 140/80. The left border of the heart was  $8\frac{1}{2}$  centimetres from mid-line. The aortic sounds were reported as being a little snappy. Fundi normal. X-ray and fluoroscopic of chest showed no cardiac enlargement. No findings of vessel changes. Electrocardiogram showed slight R-T depression in first lead only. He was considered to have a normal E.K.G. Urinalysis, blood counts, smears and Kahn were negative.

In January, 1938, a few days before he came into analysis, he had gone south for the Christmas holidays. He had also gone to the Mayo Clinic early in December, 1937, in an effort to make sure he had no heart condition. He was advised to go to a ranch and rest and, while at this ranch, he was seen on several occasions by another physician who sent the following report:

While Mr. X was in the south during the Christmas holidays I had a chance to examine him on several occasions. He first

called me one afternoon while he was having an attack of palpitation, extrasystoles and a feeling that his heart "was going to jump out of his chest."

Physical examination revealed his blood pressure to be 170/110 with a pulse of 100. The rhythm was interrupted by fairly frequent extrasystoles. The heart and aorta, as made out on percussion, were normal in size, shape and position. The heart sounds were also normal, no murmurs being heard. I did not repeat the electrocardiogram because he had had this done recently and was told that it did not reveal any abnormalities. I placed Mr. X. on a prescription containing  $\frac{1}{4}$  gr. of phenobarbital,  $\frac{3}{4}$  gr. of quinine hydrobromide and  $\frac{1}{2}$  gr. of extract of valerian. These capsules he took three times a day after meals.

Before Mr. X left, he came to the office and his blood pressure on that occasion was 135/90. He had been feeling better and had had only one or two attacks pertaining to his heart.

Due to the fact that his physical findings were perfectly normal, I questioned him rather closely in regard to any emotional strains that could precipitate these attacks. The story that I obtained I am sure you are acquainted with, as I understand you have had Mrs. X. under observation. I advised him very strongly, in fact insisted, that he see you on his return to Detroit for psychotherapy.

X-ray studies were made, with the following conclusions:

No important pathology was demonstrated in the chest. No organic pathology was demonstrated in the stomach or duodenum. There is evidence of some spasm involving the duodenal cap. There is evidence of a mild, subacute type of appendicitis. The colon shows evidence of some spasticity. No pathology was demonstrated in the urinary tract.

When the patient was first seen by me he was very self-conscious, felt fearful of the analysis and was extremely tense. He had difficulty in lying comfortably in a prone position. He talked about his ambitions to excel,

to be productive, he discussed with envy the position of his immediate superior who might retire due to poor health, and he phantasied that he might take this man's position. He was afraid to contradict his chief, however, in spite of his very aggressive attitude and in spite of his competitive driving energy he felt very inadequate and fearful of his relationship with his chief.

He admitted also that in his alcoholic moods he would indulge in promiscuous sexuality, in a rebellious spirit against the limitations imposed upon him by external social standards and by his strict conscience.

His attitude in his professional life paralleled his attitude towards his wife. He overtly subjected himself to all the requirements of the marital state when he was at home but, when far away from home, he did not limit his activities and rebelled secretly against the restrictions imposed upon him in his home and work situation. His promiscuity was, to a great extent, a rebellion against the marital chains; at the same time, he had a deep affection for his wife and did not permit any other woman to share in this feeling. He admitted that his extra-marital affairs were very temporary and superficial.

The most significant feature of his make-up was this double attitude of over-subjection to the external code and to his conscience, with extremely strong emotional rebellion against this submission. His terrifically compensatory, aggressive tendency was largely an effort to overcome his passive dependent needs.

Due to lack of time, it will be impossible to present a full case history, so that only as much as is necessary to substantiate the dynamic reconstruction of his emotional development will be presented.

The reason that he came for analysis,

then, was to obtain treatment for his cardiac symptoms, his hypertension, tachycardia, precordial distress, sense of suffocation, and fear of death. A short time after the analysis started, he described another interesting symptom which he had had for over fifteen years, *viz.* that whenever he had to catch a train he was obliged to go to the railroad station fifteen minutes earlier than train time to avoid a seminal emission. If he had but a few minutes to catch the train he would always ejaculate, so that to avoid this symptom he always left considerably earlier than was necessary. His wife and associates had observed his anxiety about going to the station early, and had often commented upon it. In addition, he was worried about the failure of his wife to enjoy the marital act, partially due to his *ejaculatio praecox*. He had also been concerned about his spastic colon, chronic constipation, and hemorrhoids, as a result of which he had had a hemorrhoidectomy, followed by a small fistula with abscess. He was suffering from marked anxiety about the health of his two sons, the elder of whom had hypothyroidism and the younger who had undescended testes. He wondered whether his own masturbatory activity, both in childhood and adulthood, had affected his children. It was also quite apparent that he was greatly distressed about his work situation because of his extremely competitive drive and marked hostility toward his immediate superior whom we will designate as "Mr. Y." He admitted having a fear that he could be rendered inadequate in his work at the whim of this man, and he abreacted with rage as he described how Mr. Y. had threatened a group of executives as to what he would do to them if they did not obey his orders. The patient had been filled with panic and resentment which he had had to repress in

his work situation, as he feared to have any open conflict with Mr. Y.

Until two years prior to coming to analysis, he had been sexually promiscuous; at times he had indulged in alcohol to excess, but only while some distance away from his home town. His work required him to make long trips, at which times he would be away from his home for weeks at a stretch. When he was a considerable distance away from home he would have contacts with prostitutes, at which time he would have fellatio and rarely engaged in intercourse because he would ejaculate prematurely and felt embarrassed. This filled him with anxiety as to his potency and increased his sense of failure about his virility. He became very guilty as a result of these experiences and would be excessively indulgent to his wife on his return home. Part of his guilt he attributed to his early rigorous Catholic training.

The patient had a fear of venereal disease and, during his adolescence, he used to go to houses of prostitution with his boy friends but he had no sexual contacts. At the age of 20 he had his first experience with a prostitute which left him with a feeling of revulsion and disgust.

The patient also had a number of idiosyncracies. He always wore stiff hats and felt uncomfortable in soft hats. He could not tolerate tight shoes and had his shoes made to order in a larger size, had them kid-lined so that they would slide on easily.

Direct quotations from his productions in the analysis show the emotional context of the material more vividly than they might be reproduced.

The patient's father was forty when patient was born.

My parents were never congenial. There was a difference of seventeen years in their ages. Mother was not settled. She always wanted to have a good time.

Father ate a lot and ate the wrong things. He would not diet and often said "I don't care if I die." He made me milk the cow when I was seven, and I had to clean the yard daily. My father got after me if I did not do the job right. It took me an hour to clean the yard before I went to school. I had to be subservient; therefore, I resent supervision now. This made me unhappy. Father made me viciously mad by his statement, "You are the cow's tail." He was in the livestock business, and he said I was always behind in my work; therefore, I was "like the cow's tail, over the behind." It was worse than a thrashing to me, it infuriated me, and I felt humiliated. I always thought the cow was dirty and that it was dirty to milk the cow because the cow would lie down in manure. I had to wash the udders with water, morning and night, when I was seven years old. I had no freedom or liberty. Father punished me by pulling me up by the ears. He would seem to lift me from the floor. I could not complain because I feared him. I hated the aspersion that my father cast on me by calling me the cow's tail. I saw a cow have a calf. It licked the calf and it seemed dirty to me. I thought it was shocking that it might eat the afterbirth. I always feared punishment from my father. Although our lot was only 160 ft. x 60 ft. it seemed like two acres to me.

Many of his screen memories showed this marked fear of his father and rage toward his mother because of her threats of castration which will be reported shortly in the material. On a deeper level the danger of reproduction and childbirth filled him with horror that birth in reality represented a dirty, bloody business, and that his own birth might be synonymous with excreted feces.

Father never danced, while mother liked a good time. When I was eleven, father took me to a saloon. He was proud of me at times. By encouragement he could get me to do anything.

Father was never affectionate, except with my eldest sister, whom he named after a former sweetheart.

Mother was psychic, a clairvoyant, believed in spirit writing. She could talk while in a trance, tipped tables, and got a definite impression as to when my father would die. I guess it was a desire for father's death. At the time I did not like it, I thought it was foul.

My mother assumed the "merry widow" role at the time my father died. She said, "Now I will have fun." She was profane and called him a son of a bitch. She could be vicious and she used to hold us by the neck, threatening to choke us. She said, "I will choke the breath of life out of you." I saw her do this to my elder sister.

Mother was morose at the time just prior to her death. She prepared her own clothes for burial. She had \$500 insurance for a proper funeral. She had a sombre, melancholy last existence, she was grief-stricken and had had a hard struggle. I felt relief in her death and a conscious feeling that she might be better off dead. I went to a priest and gave him a five dollar piece to say Mass for her soul. I had her name enrolled in a society for Perpetual Masses, and I renewed it yesterday. I cannot hold myself culpable for that situation in childhood. It doesn't mean a thing. I could shelve that feeling, yet I know it would be there. The Catholic religion has a great air of authority and fear instinct. Sin can be absolved by penance and retribution imposed by an authorized priest.

In reviewing the historical material which became revealed as the analysis lifted the amnesia of the past, the following significant episodes were recalled which are reported chronologically but necessarily in a fragmentary way:

Mother talked about her menstruation to the children. I remember she talked about having hemorrhages and blamed it on having so many children. I thought that maybe I was just a part of her bad health, as I was supposed to weigh 12 lbs. at birth; I was considered to be the biggest baby, the champion in size, so I thought I was the cause of her lacerations. I remember that a woman doctor came to the house and cut-retted mother. I heard her scream during

her confinements with the younger children. My job was to get kindling wood to make hot water. It was about 10 o'clock. I remember that I cut my finger while getting the wood and I yelled. My mother was yelling at the same time, as she was having pains. There was always yelling at our house. It was never quiet and I never remember being a child. I had to do kitchen work. My job was to make the cereal each morning. Now I resent getting food myself. I did not have the right kind of clothes or shoes. I had a limited education, for which I am very resentful. Mother engineered the marriage of my sister, which was a big mistake. She always wanted to get the older children out of the way, so that she could have her freedom.

He felt he could be a better mother than his own negligent one and, like a little girl with her doll, he wanted to give that affection of which he felt himself deprived. He was always giving, because he wanted so badly to take.

In those days, women wore trains and long dresses. Mother would stand up and urinate. You could hear her urine. It seemed disgusting to me, revolting. I would see the urine on the ground as a frothy foam. I remember once when I was in an alcove on the second floor, my mother was talking to a neighbor who said she was going to have a baby. I saw my mother cross her fingers. At the time I wondered why and it seemed such a mystery.

The patient reported in his earlier analytic hours very definite memories of his fear of castration, beginning at the age of five. He had had some sex play with his younger brother, and their mother attempted to punish him by telling him that she would put carbolic acid on his penis and burn it off. She actually took a solution, which patient now thinks contained menthol, and applied it to his genitalia. This filled him with terrific fear as to the danger of mutilation.

At the age of six years he became very frightened when he saw the bloody

dressing on the penis of a boy who had just been circumcized. As a result, he became so fearful of the danger of a trauma to the genitalia that he could not stand up to urinate until he was in the tenth year.

Another memory came to his mind of thirty years previously at the time when he began to stand up to urinate:

After I broke off the practice of sitting down to urinate, I could not make up my mind to stand up. I would look up the line. The boys would be urinating. I remember seeing a boy whose penis was wrapped in gauze and ichtyol. I remember it clearly. He said he had his penis cut off. I guess he must have been circumcized. I thought he had a dummy thing attached to his pelvis.

I was afraid I would lose my penis if I had intercourse.

This was a definitely established fear.

At the age of seven, the patient thought he was a step-child and that he had been adopted out of revenge:

My younger brother was sick and was favored by my mother. I told my mother many times that I could not be her child from the way she treated me, and that I must have been adopted.

My brother had adhesions on his penis when I was 7 or 8 years old. There was another boy in the community who was circumcized. A woman doctor came and circumcized my brother and myself. I had the idea that they split the penis from one end to the other. I would look at my penis for years later to see if there were knife marks on it. I thought there were marks on my penis and I worried. I never understood the ridge on the scrotum and thought it was a slit which had been made and then sewed up. Once my mother took my testes and shoved them into the canal; she said, "I did not know they did that." I guess she was curious.

It gets me crazy to see women in stocking feet. The reason is that my father used to make me take off his high topped boots. I resented it very much. I would hear him walking about in his stocking feet.

I had three shocks that had to do with death; my father's death when I was fifteen years old. My mother wanted me to kiss my father when he was dying, and I refused. I had a feeling of revulsion. The second shock occurred at my mother's death. I was under emotional tension on the train, as I had to ride for 44 hours. The third shock occurred when my sister died. I was afraid my mother would find out about my sex experiences with my sister.

My father used to ridicule me when I was 8 years old because of my big teeth. They resembled Theodore Roosevelt's teeth. Roosevelt was my hero so I didn't mind, but I resented my father's ridicule. I took an orange peel and carved out what were really big teeth, in order to stop his criticism and to draw laughs away from myself. He never mentioned it later. I put my tongue through the orange peels. I had the feeling I must stop this and make a joke out of it.

He therefore turned the futile barb of revenge away from his father, and deadened his inner pain by directing his conflict into the innocuous channel of playing the rôle of the suffering clown, saying psychologically, "See, I'm really not afraid, as I too can make a joke about it."

In the third grade I had a desire to lead. I have never thought of this in the past 31 years. I was in the third grade in the spelling line, and there was a dumb kid next to me. I gave him the wrong word so that I could progress ahead of him at his expense.

At the age of 9 I became interested in an eleven year old girl who was very big for her age. This girl was in the same grade and lived in the same neighborhood. She was taller, heavier, larger, and so smart, and she was doubly promoted. She was neat, orderly and methodical. These were tendencies that attracted me. She attracted me because of her superiority. It was an inspiration to me and I wanted to compete with her. I could handle all girls but this one. She put an edge on me. It was through her that the idea of competition germinated. I remember her breasts which were beginning to form. There was some com-

petition with boys because I excelled ahead of them, but she stood out in everything, in honors, and so on. I studied like hell to keep up with her.

At another time, the patient referred again to this girl as follows:

The most important thing, I think, that ever happened to me was when I was a boy in the third grade, when I sensed the beginning of the drive that was so aggressive and which has pushed me so many years.

I remember a punishment my mother gave me when I was eleven. My brother and I went swimming, so mother put dresses on us. I felt humiliated. It was a terrific shock.

At the age of 11, he remembered hiding in a closet with two of his sisters and touching their genitals. He was tremendously surprised to find that they had no penis and became quite excited as he touched the pubic hair. He wondered whether or not female children were actually castrated males.

The patient described a sexual contact with a hen at the age of ten years. He described the feeling of burning in the genitals at the time he introduced his penis into the hen.

When I was thirteen, my parents separated. I was jealous of my brother who was three years younger. My brother used to sleep with father. He chiseled and made me mad. I tried to tease him. My brother was a stutterer and I used to tease him viciously. He was the favorite.

He recalled being shocked at seeing the genitals of a laborer who was working at the house next door. When this man urinated, the patient became frightened at the size of the laborer's penis.

When I was a child, if I got a 25 cent present at Christmas, I thought it was wonderful. I was very revengeful about the manual chores and I felt sorry for myself. My younger brother was spared these

chores because he was too young and sickly. I felt I was like a convict. My mother kept a switch and gave me corporal punishment. I had to wash my own clothes. My two elder sisters never did any mending and yet I had to mend my own clothes.

I masturbated and had regular sexual tensions. There was a girl in the town who was considered to be very fast. She had an animal attraction for me. I earned a silver dollar and determined to give it to her for satisfaction. My emotions almost killed me. I was in a fog. There was a fear in back of it all, yet I had an urge. I did not know anything about sex and would not have known what to do. It seems like yesterday. I did not know about intercourse, but I was willing to pay a dollar to find out.

The patient described suicidal phantasies which presented themselves during his adolescence. He had a cowboy outfit, including a lariat, and he had phantasies about tying the rope on to the pipes in order to hang himself.

When the patient was fifteen years old, his mother left for another city with a man.

It made me have a feeling that there was a terrific bridge between us. At that time, my mother took my eleven-year-old brother along with her, saying that he would be a chaperon. She came back two or three weeks later in a jubilant manner.

I was afraid to be alone in a big house. I remember it as if it were yesterday, at dusk, on Saturday evening, 7:00 P.M. in July, 1912. Father walked to the car. I thought he did the most shocking thing. I was visiting him at the time, and the two of us were alone in the house. I thought at the time, "You old s. of a b. to go off and leave me, a child of 15, in this house." He punished me by leaving me alone. He regarded me as ten years older than I was, and did not understand children. This was the last time I saw him alive. I felt guilty because of my feeling at that time. Father would drink beer and play dominoes by himself. The house he lived in alone was considered to be haunted. I felt very nervous of being there. Even after he had gone,

his spectre appeared in front of me. After his death, I got up the next morning and took the train home.

My father never let us be wasteful. I have often over-estimated my appetite to my great discomfort, as I feel that everything on the table must be eaten. It is part of my nature. It bothers me to waste food or money. I resent paying for anything.

For years I have O.K.'d expense accounts for employees and have known they were padded. Yet I would go to a \$15.00 a day hotel and steal their towels. At the office they think I am an opposing person.

At the age of 17, the patient obtained his first job, working at a railroad office, at thirty dollars per month. He described his panic at staying alone in a seven-room house and his fear of being caged up. He had the same feeling on elevators. He also had a fear of being buried alive.

I have had phantasies about people being buried lying on their backs. I also have a feeling of fear riding in elevators. I have often wanted to tell my wife to have me buried lying on my side.

At the age of 17 he also worked in a city in the south, and was situated opposite to an emergency hospital. Each time an emergency case was brought in, he would hurry over to see what was going on. He was shocked on one occasion to see a Mexican brought in who had been emasculated. This man had committed adultery and the husband of the woman had emasculated him.

My mother left home with her seven children in 1911, leaving my father and moving to my maternal grandmother's home.

Being the eldest son, the patient had now to assume some of his father's responsibility.

He could not look at himself in the in a mirror, when shaving—

When shaving, I would feel my way

around my face, so as not to look myself in the eye.

(At this stage of the analysis, he examined himself microscopically.)

Following his release of thwarted rage, he said

I have blasted off feelings now, and can float along like anyone else.

Early in the analysis, the patient was very voluble, describing marked feelings of ambivalence towards his mother, as he tried to give the impression that he wished to be loyal to her. Yet, as the analysis progressed, it became obvious that there was more and more hostility expressed toward her, particularly in regard to the way she had cared for her children. Also, the latent content of his dreams exhibited, during this time, marked hostility to his mother, as in the dream which showed that he had tried to desecrate her grave. (See section on dreams.)

Early in the patient's marriage, there was a good deal of quarrelling, so that his wife threatened to leave him. The quarrels were due to the fact that his wife refused to have intercourse frequently, and continued to show dependence on her own family, whom the patient resented. During any period when his mother-in-law was in his home visiting, his wife always refused him coitus, which greatly intensified his rage toward the thwarting mother.

During what I call my monogamy for the first ten years of my married life, by drinking alone I could arouse a surging tide of sex.

In the middle of the analysis, the patient sent some money to an aunt to purchase some headstones for the graves of his maternal grandparents and his aunt's husband, the graves of whom were unmarked. This aunt was the woman who befriended him in 1914

when the patient was 15 years old, for a period of  $4\frac{1}{2}$  months.

I was in a dreadful frame of mind at that time. Mother kicked me out of the house. I was obstreperous. Mother and I had words and she told me to get along by myself. I felt dejected and whipped as she sent me away. I really did not want to go, but I said, "I will show you, and you can go to hell." I took a long ride on the train to my aunt's home. It was very hot and tiresome. It was Labor Day. I went to a hotel the first day. I was frightened when the bell boy asked me if I wanted a girl. There was a knock at my door at 1:00 A.M. and I felt scared.

Before he was married, he was travelling for a tire concern and stayed in a small town where there was no hotel. He had a room with a family who went several miles away to attend a movie. He felt panic-stricken at being alone and had a fear of impending danger. He reported also that during this time he suffered from spermatorrhea.

It was while he had influenza and pneumonia in 1917 that he first met his wife. This was during the influenza epidemic. His wife had volunteered to nurse patients in a hospital.

Everybody was dying, the priest came to give me the last rites. There was no excitement. I understood the meaning of the ceremony and it seemed peaceful to me. At the time I did not fear to die. I lost 40 lbs. during this time. Z. (patient's wife) came to see me while I was convalescing, after I had gained about 10 lbs.

I masturbated while in hospital. They were giving me digitalis at the time, and I became very frightened. I had the special nurse rush for the doctor. I wanted the doctor and nurse to think the pneumonia caused the accelerated pulse rate, yet I knew it was the masturbation. I insisted that he come that night. My heart was ready to jump out. I thought the masturbation made me have these heart symptoms and that I was going to die. Z. came to see me that night. I was smitten by her. She

was like a mother to me. The one day that she missed visiting me, I felt very hurt.

Two years before coming for analysis, while he was in the Northwest, he was invited to see some sexual perversions which were put on as a "show" in an Indian Reservation. When he returned to his hotel that night he thought he was going to die: he induced vomiting to get relief, had a terrific tachycardia, palpitation, and said his heart "missed beats." He traced his first fear centering around his cardiac function, to this experience, although he had earlier associated his palpitation to the masturbation while ill with pneumonia.

I had to support my mother for four or five years. She was going to expose the children to Probate Court action. In the State where she lived, parents can make a child support them. I was so antagonistic toward her third husband that I did not want to give her any money.

#### DREAM MATERIAL

Since this material is so voluminous and the time limited, only a few dreams will be presented as examples of the material revealed by the patient, exhibiting some of the dynamic structure of his neurosis. It is impossible to evaluate the dream material without paralleling it with the stage of the analysis and the life situation at the time of the dream, the transfer situation, and the meaningful character of any possible acting out of that period. However, a sufficient number of associations to the dreams, even though quite fragmentary, will be given, and an effort will be made to point out some of the latent content of the dream and its significance for the patient. Naturally, an understanding of the dreams requires a theoretical knowledge of the principles of dream interpretation, as laid down by Freud, which cannot be reviewed in this presentation.

DREAM: A Chinese woman controls the condom business. There is a partition in the rear of the store. They said I would have to see the Chinese woman to buy condoms. She either sold me three hundred million condoms or made three hundred million dollars. She did not look right to me, so I walked out.

ASSOCIATION: Last night I read an exposé in "Fortune" magazine regarding the contraception racket. The Chinese woman was repulsive. She was an Oriental. She did not look Kosher. I don't like them, I am mistrustful of them. I have the least desirable sexual associations I can picture with them. She was distasteful. The last time I went out with a woman sexually (other than my wife) was a year ago last August. I felt thwarted.

ASSOCIATION: You are the Chinese woman in the dream, by God! On the boat last summer I met a girl. She went to my state-room. Before I started to have intercourse, she took hold of my penis and I had an orgasm, and I kicked her out.

Following the dream of the Chinese woman, the patient reported that he had marked feelings of anxiety. He also exhibited a feeling of panic as he drove to the analyst's office, together with anger at his increasing dependence on the analyst:

I want to push like hell out of here. I know it is wrong to feel that way, yet I have an aeroplane fear. It makes me nervous to know you are commuting by plane. I have worked out an alternate plan as to what would happen in case your plane crashed. I am not worried about your family, but about what I can do. I worked out an alternate plan in case something should happen to you. I have done nothing for 21 minutes. I want you to talk more. (Patient turns and looks at the clock.) I resent it. In this monotonous atmosphere I must halter myself. You make me mad. You get in my hair.

This dream about the Chinese woman denotes the patient's rather grandiose wish for a compensatory virility, his

fear of castration as revealed in the direct association of the woman who grabbed his penis, and his resentment of the positive transference, which was on a homosexual basis, and he makes the analyst into a belittled, alien, dangerous Chinese woman. Patient's blood pressure was 180/120. He perspired freely, felt extrasystoles and palpitation.

I have been afraid ever since I told you about the dream that, maybe, you will send me to another doctor. I thought, "How can he take care of me if I have such thoughts about him?"

The next analytic hours revealed the following anxiety material, produced by the dream of the Chinese woman and the revealing of unconscious material:—

I am thinking about two occasions at the age of 17 to 18 when I had been drinking beer and had thoughts of sex. I was afraid of venereal disease. I went out with another couple but had nothing to do with the girl I was with. I wanted to keep up a front, however, to hide my fear. The other boy had a good time but I did not. The second time, I masturbated the girl, and the secretion bothered me. I did not know where to touch her.

I am tired in the mornings, especially if I do not take the pills. I have a feeling of anxiety.

I felt depressed and got up at 11:30 P.M. and took a capsule. I felt irritable. My wife patted me and said, "Go to sleep like a good little boy." This enraged me. It hurt my masculinity because I felt like a little boy, so I slapped her. Then I had the best erection I ever had. Z. has been revolting to me. She is like my mother. How could I lie in bed with her? I had a temporary derangement of logical thinking.

His incest guilt became clear.

DREAM: I was invited to a wedding or reception. There was nobody there but guests. I could not see the couple who were to be married. A great effort was made to prepare the food. I did not want to remain in the

guest line. I went to the kitchen and there was something in the skillet. I thought it was a doughnut. It was in grease or deep fat. It was a pretzel instead of a doughnut.

ASSOCIATIONS: I did not see any guests personally, but the atmosphere was friendly. None of the principals of the wedding were there. The name of the people was that of an important family, a prominent one. However, the wedding was in a middle-class home. When I saw that it was a pretzel I was disappointed. I felt rejected and disappointed. The pretzel was hard, stiff and brittle. It goes to pieces. The brittle pretzel (penis) is my lack of sexual vigor.

DREAM: I saw a number of little things like earthworms. Someone had been taking them up. I put a stack of them near the house. They grew to 5 ft. long and were very grotesque. The worms had not human faces but they had expressive faces. They turned around and looked at me, and they grew larger very quickly. It seemed amusing.

ASSOCIATIONS: The locale of the dream reminded me of a little town in which I lived when I was 13 or 14. I never liked to touch worms, as a boy. They are the lowest, nastiest, dirtiest form of animal life. They do not breathe, have no respiration. In the dream, the worms were laid in a stack. It was a stack of crap. If they had heads they could eat. It makes me think of perverse sexual acts. I make no effort to do things. In the analysis, this dirt comes out. It gets bigger and bigger.

The patient's blood pressure was 190/130. This dream suggests symbolically the anal penis and his resentment of his younger, favored siblings whom he equated as dirty, eating worms.

DREAM: I was on a train. Z. was with me. I thought the train was late but I did not mind, and I was not worried about being late.

ASSOCIATIONS: The patient is reminded of his numerous dreams of trains. "The trains are like faeces." The patient is resentful

because there is a change in the analytic hour. He expresses great rage. Then he associates that, in the dream, the train is uncoupled. "I am apprehensive for fear the train will leave. You are a hell of a doctor to leave me. To hell with anybody else. I now feel the fear of missing the train. I had the impression of sitting on a curb in the street and am amazed to see a long discharge come out of my penis."

(Blood pressure 200/140).

ASSOCIATIONS: Trains are faeces—fear of semen running out like urine—aggression.

DREAM: I had a dream about backing out of the garage. There is a cement apron to get into the garage. The yard is closely confined. I backed into the wire fence and tore it all loose. I was having a hell of a time straightening it out.

His anal aggressions were marked.

ASSOCIATIONS: I could not sleep last night. I had a miserable night. I wanted to back into you. Somehow or other, the car makes me think of attacking you. I am jealous of your other cases.

The dream indicates the transfer and his resentment of it, expressing itself in attacking rather than in being attacked.

DREAM: I was going into the country and I went to a country house. On the porch there was a package. Instead of a bouquet of flowers, it was a big, flat box of flowers. I had the feeling of having to pay a debt, like calling for a social courtesy. In the box were several spiders. I wanted to get away. Spiders make me afraid.

ASSOCIATIONS: It was the house where I was born—a poor, frame house. There was nobody in the house in the dream. Six months ago, I took my son to see this house where I was born. The house is lonesome. There were plants, like tomato plants, but no flowers. I expected somebody to be there. I do not like insects. I like clean, black dirt. I do not like spiders. Spiders remind me of my mother. They are dirty, crawly things.

DREAM: I was walking in a city about 9 o'clock at night, walking through a dark neighborhood. Then I came through a lighted, old-fashioned community of the 1910 vintage. I remember the arc lamps. I crossed a railroad where there were a score of little shops. Then I looked at the railroad, thinking of buying a ticket. I bought a ticket for a place seven to eight hundred miles away. I thought I would buy a short ticket on contingency, to ride a short way into the country. It was a certain kind of train. They call it the "Cotton Belt" route. The route runs down. As I was on the day coach, the conductor came through to get the limited distance tickets. I checked on the long distance ticket. I remarked to somebody that it was peculiar that the conductor had taken both tickets. I woke up in a panic, and the train seemed to be going like hell.

ASSOCIATION: I think it is the analysis. I want a short analysis. However, I realize that I have got a long way to go. I have mixed emotions. I wanted to kick away over the short line. I remember the long day coach trip I took to my aunt's house. I have day-dreams of intercourse and less fear. I have phantasies about sex.

He was reminded of leaving his mother when forced to leave his home. "The Cotton Belt" reminded him of the Kotex belt of a woman, his feminine identification. He had had several dreams of belts, one of especial interest in which he became an old tramp with torn, frayed pants, which were, however, held up by a good belt.

DREAM: An old, old cemetery. I had a suspicion or a superstition about stepping on graves. The monument was low. I was confused. I felt distracted. The grave was close and I just had time to keep from walking on my mother's grave.

ASSOCIATION: It reminds me of my mother's cemetery. Her death was a shock. It was sad. She was buried in a grave, not a family lot. The markers were low on the ground, and there was difficulty in finding the name. In the dream it was a shock and surprise to

find I was standing on it. Knowing that I have no intention to do so, I excuse myself. In 1913 I had an attack of melancholia and the only way I could get relief from my grief was to visit my father's grave. I got great psychic relief and wrote Mother what I had done. I was always anxious about driving by an undertaker's and so would take a different street if possible.

This dream showed his depression as a result of guilt produced by his hostile feelings and death wishes for his father.

DREAM: A manicurist was standing beside me with a razor in her hand. She was shaving my chest. She started at the top of my chest. I felt the razor and awoke.

ASSOCIATION: I had a date with a manicurist who was menstruating. I had two drinks and wanted to have relations. Hair on the chest means virility. I pleaded with Z. for sexual relations. The minute she touched my scrotum it scared the hell out of me. I was frightened.

Patient has had fears of emasculation and that intercourse meant castration by the woman whom he thinks possesses the knife or penis.

DREAM: I was hooking up the front axle of a car with a hydraulic hoist. I tried to jack it up. The axle was straight in the center and curved back at each end. I did not understand how the axle was bent back.

ASSOCIATION: The axle is the most important part of the car. It holds the car together and steers the wheel wherever you want to go. Mr. Y. and Z. are not playing straight. Y. persecutes me and orders me around. Z. says my "mind is between my legs."

The dream shows his projected suspiciousness towards his wife and chief, really his father and mother.

DREAM: Either I was standing, or somebody else was standing, and holding a piece of fecal mass. Curved in waves. Somebody was pulling it through my hands.

ASSOCIATION: I masturbated last night be-

cause Z. refused me. Instead of intercourse I get shit. I feel humiliated—a dirty feeling.

DREAM: I saw an ore train. It was an old locomotive, pulling out of a pit on the upgrade, with a great deal of effort. In front of the engine was packed cakes of clay, mud, peat or coal—8x8x30" long. They were all over the engine. There were 7 to 8 ore or dump cars on the back, filled with this material. The train came in front of me, pulled to the right, and gained momentum. I decided to follow it in my car. Then two or three trains ran parallel. One went so fast that it jumped the tracks. I tried to follow and went into the ditch. Two others went on and I fell through a wooden bridge that had a big hole in it. I had to stop my car to prevent going through. I got out of my car and went to a stranger's house—a farmer in ordinary circumstances—and asked him if I could stay there the night on account of the flood. He said O.K. and then I woke."

ASSOCIATION: I am trying to make the grade. You are the farmer. I am pulling shit up the hill. I have goose flesh all over my body. When I hurry for a train and fear missing it, I'd have an orgasm. I'd usually not catch it. Now I go to a train 15 minutes early to prevent an orgasm. I have been doing this for 15 years.

Patient is reminded of having to leave his mother and go by train to his aunt. His terrific catastrophes regarding sex, circumcision material, and castration fears were reviewed. Orgasm if train missed, to pay back for mother throwing him into the world. As Abraham has pointed out, the seminal emission here is like urination. Patient associates further: his worry about sex when he first left home, his melancholia, feelings of depression—"I felt like an immigrant"—his resentment of his mother's two re-marriages—"I felt like an orphan." His wife offered him mother love when he was ill in hospital with pneumonia and flu, and his attachment for her was that of a mother to a son.

Then he describes his fear of being in a bath-tub, also masturbation in the tub. His fear of urination and defecation—pregenital fears—the flood and the faeces pulling him back.

Let us crystallize briefly at this point some of the deeper unconscious implications:

The dreams show condensation of castration wishes—penis envy—screened material—masochistic tendencies towards women. The patient uses his castration fear for ulterior purposes and motives, with guilt feeling. He misses the train, therefore castration fear—ejaculation equals castration. Semen runs out like urine, without control, urethral eroticism.

The patient had read an article as to men being in prison. At the time he wondered what people did regarding when they were in prison:

DREAM: I dreamed about a woman who visited her husband when he was in prison. They talked through a screen. In the dream I thought the worst thing would be the lack of sex. The woman in the dream was a blonde—I noticed her hair. She came to see him, and maybe she could not see him.

ASSOCIATIONS: The emotions of a man in prison who cannot see his wife must be very irritating. I feel that the endearing tendencies toward Z. are less marked. The blonde woman in the dream is Z's sister-in-law to whom I made love. I was not unhappy in prison as I was busy. I think the important thing in the dream is that the woman was unhappy as she had no sexual outlets. In prison I did not mind waiting. In the dream I was sympathetic to the woman.

The patient's passive homosexual tendencies—identification with the woman because her sexual needs were not satisfied. He protects his masculinity by being in prison.

The patient describes a sexual experience with Z's best friend who came to his room. He recalls that he thought

"What would Z. say if I had no penis?" He again tells about his belief that to have coitus is to be castrated. He tells about his bravery in having fellatio because it makes him feel there is less danger with fellatio as he has sufficient courage to risk having his penis bitten off. He discusses his fear of losing his genitals in fellatio:

I fool myself and the women into believing I will go through intercourse by putting on the condom. Then I would take the condom off and have fellatio.

The patient is concerned about his bowels which he thinks are "tied up." He describes his feeling of loathing for tight collars, tight overcoat, stiff hat or Derby, and tight shoes.

DREAM: I was in the city of X . . . I was going to the station to take a train. It was an early train. As I got to the loading platform I saw that the 9.45 left so I knew that I would have to take the 11 o'clock train. I felt disappointed. The end of the car looked like an enormous Pullman car with a double row of exposed berths. There were two tiers of people, all in bed, looking out through transparent walls. They were all women. The end of the car was marked like it was a car from Mexico. Then I noted that it was a short line train. I went back to the hotel. I passed one bedroom which was in disorder. I went on to another room. On the door was hanging a woman's heavy suit—the color was rust brown. I looked at it and could not figure it out.

ASSOCIATIONS: I was sensitive regarding missing trains. Z. joked with me for 15 years about my going to a train too soon. I always got there too soon. Whenever I hurried, even in the dream, I would have a wet dream, especially when I thought of trains. I always bragged about making trains. In the end car there were only women, partially dressed. It was very seductive but I felt disappointed. I recall a memory of something that happened in 1920: there was an old woman and her daughter, about 20 years old, in the train in a lower berth. I had the upper berth and

saw the girl's breasts and got excited and masturbated on the train. M—— Z—— and the woman in—— both Southern. There is enmity between this woman who is Z's first cousin, with whom I had intercourse. If Z. would know she would lose her mind because of jealousy. I am fearful. I think she is more sexually aggressive. I asked her to undress in front of me last night. I wanted to rape her and felt frustrated. When I went to bed, my sexual drives went off (like the train). Z. was surprised that my erection was gone. I felt punished for my rape desires. Z., for the first time since our marriage, touched my penis. In the hotel one bed was slept in. I recall that the other bed was clean. Paradoxically, I feel fine, I thought that sleeping in one bed means sleeping with a woman.

It had to do with the secretary I had five or six years ago. That was the time I was on the loose. I arranged for her to meet me in——. In the dream she seemed to be over 6 ft. tall. I had no sex desire in the dream. I talked with her on the street in the sunshine. I asked her to send a wire for me, so she handed me a pencil. Instead of being 5 or 6 inches, the pencil shrank to 1½ inches. The pencil was not sharp. I woke sharpening the pencil.

I remember when my secretary met me. Z. was pregnant at the time. I had had no sexual contacts with her from about the seventh month on. It was a conniving and secret meeting. I was careful, yet I now know I was an amateur. She said she needed a hotel reservation and did not have one. She said she would like to go to my hotel to wash up. When we got there she said "Let's have a drink." We had intercourse and I felt disappointed.

Patient shows castration fear. Pencil is the penis, and the patient is afraid of the big woman who has the penis. Definite association with the omnipotent woman who has a penis.

DREAM: I was driving a car about thirty miles an hour. From the opposite direction was coming a bright green, new Chevrolet, coming towards me. As it came closer, I noticed that the body was made of rubber.

It went around me and I didn't see how it got by me. The car got so close to me that it grazed me. It was reckless driving, formidable, vicious. The driver of the other car reminds me of my superior, Y. He has something that I want, yet he envies me. I am younger and have been in the organization longer than he has. I did not give an inch from my side of the road. I worried to beat hell about my bowel movements Sunday. I had three movements, but I had none today, so I took a suppository. I think faeces are valuable.

He had many of these rather typical dreams of being attacked by a man.

#### UNCONSCIOUS DYNAMIC BACKGROUND

During the course of his analysis, some of the deeper mechanisms were very clear, *viz.* his rebellious, aggressive attitude against the restrictions of marriage (behind which his mother stood as a threatening, contracting individual in his personality development), his terrific hostility toward his superior, which he expressed openly and freely in the analysis. Yet these feelings were accompanied by anxiety, feelings of guilt, and were colored by strong passive, masochistically colored feminine tendencies and wish for dependency. With the progress of the analysis, more and more unconscious homosexual material came to the surface, both in dreams and in the transference. In the dreams he was usually attacked. His feminine tendencies had a definitely masochistic tinge, particularly in those dreams in which women appeared in the masculine rôle, women who possess a penis, and so on. In this passive, masochistic attitude, two elements were discernible: 1) a guilt component, and 2) a feminine element. He relieved his guilt feeling and, at the same time, obtained passive feminine gratification. His rebellious aggressiveness and hostility were reactions against the passive feminine at-

titude. This well known neurotic, vicious circle, as described by Alexander, was solidly established in him; his unconscious, masochistic feminine wishes hurt his masculine pride, drove him to rebellion, increased his competitiveness and ambition. These tendencies, however, created guilt and fear which made the struggle for life too strenuous, and thus intensified his longing for dependence and retreat. The thus increased passive dependent wishes, however, could not be accepted by his ego. Under the pressure for success, he had to struggle relentlessly against his deep longing to be taken care of. To some degree he gratified some of his submissive dependent wishes by giving his wife full control of their social life, allowing her to make all decisions and assuming toward her the rôle of the adolescent toward his mother, a peculiar mixture of obedience and surreptitious revolt. In his dreams he regresses back to the oral dependent attitude of the child toward the mother, *viz.* oral dependency. His retaliative, anal, aggressive and destructive tendencies were also exhibited in his dreams.

In the analysis, his jealousy—particularly of other patients—was traced to the regressive tendency with which he must have reacted with great rivalry toward his younger brother who had been so ill that he had been favored by the mother, resulting in the patient's envy and retaliative teasing and cruelty toward this younger brother.

The dynamic picture, then, was one of extreme polarization of the emotional life. On the one hand, there was the wish towards the infantile rôle of dependence and the feminine rôle of submissiveness and passivity, counterbalanced on the other hand by the opposite attitude of ambition, perfection and masculine superiority. The passive regressive tendencies hurt his

pride, stimulated his aggressiveness, whereas the aggressive, competitive tendencies created fear and a longing towards the security of the passive situation, of being loved and cared for.

The analysis revealed that, following orders issued by his superior, his dreams constantly showed rebellion against authority. This emotional blocking accounted for a certain recurrent characteristic in his dreams about catching a train, which was associated with seminal emissions. In these dreams he had a feeling of utter futility. In other words, he felt he could not respond in a virile manner. On deep inquiry into his fellatio experiences, he tried to hide his fear of castration in coitus by showing bravery which would permit him to experience this form of sexuality. At the same time, there was the wish for castration because then his feminine wishes could be given reign and, as a penisless man, he could be passive. In his sexual relationships with women there was definite secret passive gratification, namely through identification with the sexual partner.

Readings of the blood pressure usually showed an increase preceding and following an analytic hour during which there had been a release of hostility, or when the rage had been marked. Early in his life, the patient had repressed his rage toward his father because of the danger involved in the possibility of retaliation. He also had been fearful of expressing his hostility toward his mother because he feared the loss of her love and he admitted that he thought he had been adopted. He was actually forced to leave his home at the age of fifteen. His early memories in relation to his parents were overshadowed by gloomy, depressed feelings, consisting of his continual struggle about sexual inhibitions and his conflict with his internal insecurity. Many of his conflicts were

traceable to this early inhibition in the sexual spheres but, with his increasing biological urges at puberty and the association with the stimulated sexuality at the time he was forced to leave his mother's home, the later neurosis pattern of feeling impotent and castrated became more apparent.

The genesis of his neurosis partially resulted from his early introduction into sexual play with his brothers and sisters, the threat of his mother to castrate him as a result of this, his abusive punishments, his actually witnessing of the bloody bandages of the boy at school who had been circumcized, the anxiety regarding his own circumcision experience, the sight of a mutilated penis, the fear that his sisters were actually castrated males, his inability to stand up to urinate as a boy, and his equating of urine and semen as running out without control. In addition, his inhibitions with regard to sexuality at puberty were all clear-cut and worked through in the associations to his dreams and his conscious reconstruction of the origin of his emotional tensions. His *ejaculatio praecox*, similarly, was equated with the loss of urine in terms of his passive homosexual identification. The seminal pollution connected with trains in this way became associated with urethral eroticism in the process of which he was giving back the forbidden to his mother. His fellatio represented actually his fear of intercourse, which he admitted as a possible castration, and to show his courage he would fool himself and women by putting the penis into the mouth, actually to run the physical risk of penile amputation.

In the latter period of his analysis he recalled many of these sexual traumata in great detail, to which he actively abreacted. He came to understand the strong internalization of his severe conscience arising from the

external intimidations of his father, mother and church, which produced his terrific super-ego guilt.

His wife was really a mother who cared for him during a severe initial illness. When she did not visit him during his convalescence, he masturbated, after which he had a panic reaction which he then feigned as being a heart attack, insisting that his physician be called to administer more digitalis.

His submission to the repression which he first experienced in his early youth, under the external compulsion of his parents, became eroticized. It was only in a passive, feminine identification, then, that his ego could make the best out of a painful situation, even though on the surface he protested violently. This unconscious masochistically colored feminine attitude made him very resentful and, in the transfer situation, produced great anxiety and rebellion against the analysis until it was worked through.

The blood pressure was usually taken every hour—sometimes at the beginning and again at the end of the hour. It was found that the blood pressure rose when the material indicated a release of aggression and hostility. The nature of his emotional state had definite relationship to the height of his blood pressure for, when he was aggressively irritable or apprehensive, the pressure was higher. Usually, anger and embitterment, particularly towards his superior and towards his wife, elevated his blood pressure. Often the two were associated together in his dreams.

In the last part of the patient's analysis, his seminal pollutions entirely disappeared with regard to trains. His blood pressure during the period of eighteen months since the termination of the analysis has shown a consistent average of 128/80. He has shown no cardiac neurosis or symptomatology. he now drinks in moderation, is well

occupied socially, engages in active athletics, plays squash three times a week, and golf frequently during the summer, and is much more cooperative with his superior. He describes his relationship with his superior as "being willing to go downstream with Y. rather than upstream against him." He feels less guilt about sexuality and with his wife there is a larger degree of amiable and satisfying sexual relationship. This has been substantiated by his wife who admitted that, for the first time in nineteen years of married life, they have found each other satisfying sexually. The patient's internal tension has been relieved and his relationship with his children is less anxious. He feels that everything is being done for them medically, and he is much less concerned.

#### SUMMARY

A case of essential hypertension has been analyzed and reported. In addition to hypertension, the patient suffered from seminal pollutions, ejaculatio praecox, anxiety, a cardiac neurosis accompanied with precordial distress, tachycardia and extra systoles. The analysis was terminated after the patient had remained symptom-free and well for over two months.

This conflict situation showed the classic picture recently described by Saul, published in the American Journal of Psychiatry, Vol. 95, May, 1939, No. 6, namely: a masochistic submissive and an orally dependent attitude towards a dominating mother, leading to a masochistic submissive attitude to a rigid superego and, homosexually, a deep attachment to the parent of the same sex. Further, there developed a chronic, unsuccessful, unsatisfied rebellion and hostility in protest against this submission. The rebellion and hostility were conscious, or near to consciousness, but yet not expressed directly because

of fear of loss of love. The masochistic homosexual submissiveness was not conscious and bitter hostility opposed making it conscious in the analysis. Another prominent feature was excessive fear of heterosexuality, which was to some extent indulged, despite the anxiety. The crucial point for the hypertension seemed to be the hostile rebellion against the masochistic submissiveness with consequent anxiety.

This male patient was also masculine-looking, used sexual promiscuity and alcoholism as outlets and showed the chronic rebelliousness particularly in relation to his superior in his work situation.

The evidence in this case, then, suggests that this patient's hypertension may be connected with long-continued repressed hostility and rage, with the consequent production of constant conflict which the individual can neither escape nor solve. This would be in accord with findings reported by others. Therefore, in the condition of essential hypertension too, as Virchow has aptly stated in his dictum: "We must treat not only the disease, but also treat the patient." Such treatment necessarily involves an evaluation of the patient's personality and emotional development, seen in historical perspective.

## A BRIEF NOTE REGARDING A PURPOSEFUL ACCIDENT

EDWARD WEISS, M.D.\*

A VERY OBESE, hypochondriacal, middle-aged, white woman had been obsessed for several years with the idea that she had cancer of the throat and despite the reassurance of many physicians who had studied her carefully, she continued to believe "that there must be some physical basis for the pain and burning sensation in the back of the throat." She also had a great fear of infection, was meticulously clean about her home, and was forever washing her hands. She was very insistent about having something done for her throat and she herself would make topical applications of irritating solutions until, on many occasions, bleeding occurred. Even this did not satisfy her need for suffering so that she finally succeeded in persuading a dentist to remove her perfectly good teeth. She encountered less difficulty in sacrificing her tonsils. Both operations gave temporary relief but the symptoms returned worse than ever. She was so fixated upon her physical symptoms that it was impossible to accomplish more than the most superficial investigation of her life situation. The only digression she would make from a discussion of her physical symptoms was to upbraid her local physician for fancied mistreatment and insulting behavior. He had sent her to me for a general diagnostic survey but continued to supervise her care. She spent a great deal of time criticizing him for a lack of interest in her condition and for the "contemptuous way" in which he treated her. Never-

theless, it was obvious that underneath the surface hostility there was a very positive attachment to her physician which was indicated by her continuation under his care and by such statements as "she had great faith in his scientific ability; on occasions he had been very kind to her; and her children and her husband were devoted to him."

She was a very religious person and went to church every morning seeking help for her illness. I had refused to help her to decide whether to leave her local physician, and so on one occasion when she felt that she had been more than ordinarily mistreated by him, she went to church to seek help in making a decision on two related questions, first whether finally to quit her physician and seek another and secondly, whether for financial reasons it would be better to give up a health insurance policy which provided nursing service in case of a confining illness. She had carried this costly policy for a long time without realizing benefits and now her funds were low. On the particular morning in question she prayed for help in making these two decisions. As she left church she noted that it had been raining and while ordinarily, because of her overweight, she took special precautions in descending stairs, "she was not as careful as she should have been" and on reaching the third of three steps, slipped on a wet spot, fell and fractured the left ankle. As she explained to me on the telephone the next day, "she got her answer quicker than she thought." She seemed in a cheerful frame of mind as she told me, with evident satisfaction,

\* Department of Medicine, Temple University Medical School, Philadelphia.

that her physician had immediately responded to the call after this accident.

#### COMMENT

Aside from the purposefulness of the accident<sup>1</sup> the marked ambivalence for her local physician was the striking feature of this case. Just as many neurotic people take up much time in criticism of some member of the family, just so did this woman express herself toward her physician. On the surface she was markedly hostile and yet she continued under his care and obviously held him in great respect and even with some evidence of underlying affection. He found the patient a very disturbing factor in his practice and confessed to

me that when it was necessary to see her, "it made a wreck out of him." When the psychological background of this relationship was explained to him, he found matters a little easier, but needless to say, was pleased when the patient finally made up her mind to place herself under the care of an older physician who had "taken care of her in childhood." Because, to conclude the story related above, once the fracture had healed, she was back once more with her old throat complaint and criticism of her local physician.

The ambivalent relationship to her physician, so excessive in this particular instance, is a very important element in the doctor-patient relationship, as yet not at all understood in general medicine.

<sup>1</sup> Dunbar, Flanders: Emotions and Bodily Changes; A Report of Some Recent Studies, *Am. Int. Med.*, 17: 839, 1940.

# BOOK REVIEWS

JELLIFFE, SMITH ELY: *Sketches in Psychosomatic Medicine*, Nervous and Mental Disease Monographs, New York, 1939, 55 pp. \$3.00.

"I have," writes Jelliffe in the introduction of this book, "brought together these few papers under the caption of 'Sketches in Psychosomatic Medicine' to gratify my own satisfaction in having written them and to further the conviction that they have been worth while and the hope that they will be of service in the understanding and therapy of similar and related conditions still imperfectly dealt with in medical practice. The general ideas stem from the Socratic principle of the wholeness of the body and as related in Plato's Charmides, 'one looks to the cure of the "soul" in order to cure the body.' Freud for the first time rendered the 'soul' accessible to conscious perception and offered a method for gaining insight into dynamic principles of creative and destructive tendencies without which no real psychosomatic unity is understandable."

From the historical point of view the earlier papers were written before Jelliffe knew of Groddeck's work in which latter the principles were worked out by Jelliffe at times in considerable detail are but suggested in Groddeck's contributions. When Jelliffe wrote some of these and related papers and brought them before notable psychiatric confreres, at the best they were received in conservative silence. Today psychosomatic medicine has become a pass-word of progress.

The already well known, often read and frequently quoted papers themselves cover a broad field indicating the author's very large scope of research. In some chapters general themes are discussed, as for instance, in the chapter: What Price Healing?, Psychopathology and Organic Disease; The Psyche and the Vegetative Nervous System; The Bodily Organs and Psychopathology; and his famous paper: The

Ecological Principle in Medicine. But half of the book is focused upon more special, strictly limited problems, as for instance, the chapter about Dupuytren's Contracture; The Skin, Nervous System and the Bath; Neuropathology of Bone Disease; Myopia.

The author has published here contributions which represent an important part of the pioneer work of psychosomatic medicine. It is to be hoped that Jelliffe will realize his promise to collect many more of his publications in similar form.

MARTIN GROTJAHN

DUTTON, WALTON FOREST: *Headache and Head Pains (A Ready Reference Manual for Physicians)*, F. A. Davis Co., Philadelphia, 1939, 301 pp. \$4.50.

Sandwiched between A (Acromegaly) and Y (Yellow Fever) are approximately 200 affections causing headache and head pains. The problem of psychosomatic medicine "of differential diagnosis, of pathological processes or of surgical technic may engage the primary interest of the scientific physician and surgeon, but the suffering patient requires the alleviation of pain as a crying need." Therefore, this monograph will familiarize the physician with conditions that will prevent self-diagnosis and undue medication and will advise him how to treat headaches. Hundreds of proved and tested prescriptions are given with exact dosage and precise instructions on the treatment and the practical management of each case. The "Therapeutic Index" with ready answers on what to do furnishes a quick-reference guide.

MARTIN GROTJAHN

ROBINSON, G. CANBY: *The Patient as a Person (A Study of the Social Aspects of Illness)*, The Commonwealth Fund, New York, 1939, 423 pp. \$3.00.

Problems in social diagnosis and social treatment are constantly before the physician in the hospitals and dispensaries and for the sake of the medical student's

training and the patient's welfare they should not be ignored. Whose duty is it to understand the human problems which surround but are apart from illness? is the question which the author asks. The recovery of many patients can be hastened by relieving mental doubt and worry that may be wearing down the courage of the patient. The author reports about thirty years of his experience and about his activity which could be called "Medical Social Work" and which the author does not call psychotherapy. So far as he is concerned he knows only one "basic adverse condition . . . personal inadequacy."

The case material consists of 174 records of the Johns Hopkins Hospital collected in the years 1936 and 1937. The author discussed with these patients their problems of "work, habits, associates, family, church, or any other topics that seemed to contain a problem." Advice and help, reassurance and social report were then offered. In 71 per cent of the cases "adverse social conditions" were of importance. In 4 separate chapters the author then repeats the main point of his book in special groups of patients with circulatory, respiratory, digestive, diabetic, syphilitic and neurotic symptoms. Everywhere he describes the interrelation between illness and social situation of the patient.

Having read the book, which is written with so much sympathy and so much kindness of a physician towards his patients, the reader feels in full agreement with the author but he also feels like studying the platform of a political party and comes to the conclusion, "All right—so what?"

MARTIN GROTHJAHN

SELLING, LOWELL S.: *Men Against Madness*, Greenberg, New York, 1940, 342 pp. \$3.50.

"No one should be surprised," so starts the author in the Foreword, "if at the end of the next twenty-five years, more than half of the sick persons admitted to our hospitals would be discharged as cured."

Criticism of this statement would contain in condensed form a criticism of the entire book and the style in which it is written. It is quite obvious that many hos-

pitals will have dismissed more than half of their patients in less than twenty-five years—if every admission of a person in an epileptic attack or with symptomatic psychosis or in schizophrenic episode or in a manic or depressed period is counted. That such dismissals should be called "cures" is highly doubtful. If, however, the author by this sensational statement should mean that the future will bring such an amazing reduction of the *chronically* ill and if he actually should mean cures of the patient, then the more pessimistic among the psychiatrists will calmly sit back and wait for twenty-five years and see who is right.

"The fight against madness" proceeded according to the author through four steps which are used in the arrangement of the book. First, the ancients had need to recognize the fact that illnesses of the mind were ailments which could be studied. The early analysis of disordered mentality was aided by the work of great anatomists, including the genius, Leonardo da Vinci. The next step was to treat the insane as patients. The stories of Conolly, Pinel and Miss Dix are given as models of progress in this direction. The next two steps were taken simultaneously for with refinement of medical methods it was natural that the study of mental disease should split into two parts. One, taken by Gall, Claude Bernard, Hughlings Jackson and the others who studied bodily function with relation to the mind, culminated in the stupendous contribution of Wagner-Jauregg. The other pathway was that down which science was led by Mesner, Braid, Bernheim and Sigmund Freud, whereby diseases of obscure origin could be treated by psychological rather than medical means.

Modern shock-therapy, in which the layman is highly interested, is discussed in one short paragraph only and the very interesting eugenic approach to mental disease by sterilization is not mentioned at all.

MARTIN GROTHJAHN

PREU, PAUL W.: *Outline of Psychiatric Case-Study*, Paul Hoeber, Inc., New York, 1939, 140 pp. \$1.85.

This book is valuable in its aim of "training house officers as to what facts should

be recorded in the thorough study of a psychiatric case." It is a detailed statement as to what to ask the psychotic patient and his relatives. As such it will be most useful. However, practically no recognition is accorded the psychoneuroses: the reader is not instructed as to what features to look for in the history, mental status and physical examination of the neurotic patient. The autonomic nervous system is barely mentioned. Points aiding in the differential diagnosis between the neuroses, *i.e.*, the anxiety neurosis and hysteria, and surgical and medical diseases are not taken up. One misses, too, a discussion of the interesting psychiatric symptoms that come under the general heading of feelings of depersonalization, and of alterations in body form, of dysaesthesias and somatic delusions. The symptomatology of the aphasic patient and of those with other cortical or subcortical lesions is not mentioned. Some treatment of the subject of the exploratory and the psychotherapeutic interview would not be irrelevant in a book on psychiatric case study. Instruction as to the relationship of the case data to diagnosis, prognosis and therapy would have been helpful.

The author's book will be of considerable aid to the beginner in his attempt to clarify for himself the confusing picture presented by the psychotic patient. To the more experienced physician, it is of problematic value.

S. P. HUNT

MUNCIE, WENDELL: *Psychobiology and Psychiatry; A Textbook of Normal and Abnormal Behavior*, C. V. Mosby Co., St. Louis, 1939, 739 pp. \$8.00.

For many years psychiatrists have wanted to know what are the essential points of the Meyerian teaching, how does it differ from other schools, what are psychobiology and the various ergasias, and the underlying concepts. Now in this 739-page book we have a "voice from the workshop," from an "untiring and determined worker who does not have to borrow his urge for inquiry from the problems in vogue" (Adolf Meyer's Foreword). Dr. Wendell Muncie, for a decade one of the

right hand men of the Phipps Psychiatric Clinic, was selected by Dr. Meyer to present the concepts and teaching principles which have been built up by the many years of consistent and persevering efforts of one of the more important figures in the whole history of psychiatry.

"This book," says the author, "written at Dr. Meyer's invitation, attempts to give a fair account of the conceptions, teaching and working methods of the Clinic as currently constituted, with enough historical background to make the present understandable as a developmental product from the past and to give a vision of the future."

A description of the material that constitutes the backbone of the Meyerian teaching is given in Part I. The Student Personality Study with its self-searching analysis, the dynamic life chart, the perplexing synthetic cat with its experience-structure problem, and a discussion of the various psychological tests used, etc., are all clearly outlined. Part II is concerned with abnormal behavior, the methods of investigation, detailed illustrative case histories, and comparison with the methodologies and concepts from other schools of psychiatry, especially the Kraepelinian and psychoanalytic. Part III, about 70 pages, describes the treatment of the minor and major psychoses. In part IV there is a historical survey in bibliography of the development of the concepts underlying the principal reaction sets, given in outline in parallel columns.

Thus this book in covering so much territory is ambitious in scope. Besides concerning itself with a description, a comparison and then a defense of the Meyerian system of psychiatry, it contains a fund of general psychiatric information. Written by a prominent pupil of Meyer's, it is a book that deserves the attention of those psychiatrists who either want to understand the Meyerian concepts or the general practitioner who wishes to possess a book crammed with psychiatric knowledge. Its style has both fluency and the clear-cut, unequivocal character that is typical of French medical literature but is often lacking in our own—and those who know Dr. Muncie recognize here the truth of Buf-

fon's statement, that "le style est l'homme même." This book altogether has the advantage of discussing in a straightforward manner concepts which have been poorly understood, often confusedly, superficially or facetiously treated, or neglected. In giving a concrete meaning to the concepts of the Meyerian School, the author performs an exceedingly useful function.

The task of the author was not an easy one, involving as it did both organization of data and concepts and their interpretation. At best it is most difficult to convey honestly, clearly and sympathetically—and at the same time critically—the concepts of a living collaborator, and it is even more hazardous to interpret the meaning of another; witness the religions of Christ and of St. Paul, the systems of Aristotle and of the Scholastics. Probably every creator, even though pleased by his following, is disappointed to some extent in the interpretation of his work. Nevertheless the message of the prophet is unfortunately only what the disciples—present and future—can make of it. But, is it not asking too much to expect an unbiased criticism of that system and school with which an author is officially identified? We therefore condone a certain compromising patness in dealing with the fundamentals of normal and abnormal behavior. If the book lacks that spirit of penetrating evaluation and self-criticism which one would like to see in a book of this size, it presents so lucidly the facts of the material upon which the concepts are built that one may supply his own evaluation.

As a book valuable for its information there is little to criticize. Opponents of Meyerian "ergasiology" and "psychobiology" may take exception to the teaching represented, or some others to those passages written in bold defense of the concepts and system that the author describes. For example on page 140 under "Objec-

tions to the methods and aims of psychobiology: their refutation," the objections are not fully or adequately refuted, or the argument is weakened by an apologetic treatment. The author's point would have been stronger if he had let the material stand on its own legs rather than declaring himself its champion and undertaking too briefly its defense. The comparisons with other schools are well selected and informative.

Dr. Muncie has faithfully discharged the important duty of helping to clarify the Meyerian concepts and to organize the material accumulated at the Phipps Psychiatric Clinic, and for this he deserves much more credit than is usually the reward of those who attempt such a task. His book is the report of the teachings of an eminent chief by an intimate though independently thinking pupil, written from a broad historical approach, including a mass of correlated psychological and experimental data, brought up to date, the fruit of an active and honest mind with a thorough knowledge and understanding of his subject. For those unable to come in contact with the Meyerian teaching who wish to know its tenets, the reading of this volume is obligatory, and for those already "in the know" the book is a most valuable and welcome reference.

W. HORSLEY GANTT

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# NOTES

THE NATIONAL RESEARCH COUNCIL, and the Board of Editors of PSYCHOSOMATIC MEDICINE, agree that the present emergency created by world events makes it imperative to turn attention to the place the physician may play in the Defense Program. One aspect of this problem is the important part the psychiatrist as well make take. Therefore, in place of the usual reviews of current literature, we are reprinting the following circular issued by the National Headquarters of the Selective Service System in which the reader will find outlined the need for psychiatric cooperation. Readers are urged to write to the Journal concerning any critical comment or suggestions which they may have as to the best manner of fulfilling this need.

STATE DIRECTOR OF SELECTIVE SERVICE.  
STATE MEDICAL OFFICER.  
CHAIRMAN OF BOARDS OF APPEAL.  
CHAIRMAN OF MEDICAL ADVISORY BOARDS.  
CHAIRMAN OF LOCAL BOARDS  
EXAMINING PHYSICIANS.  
MEMBERS OF MEDICAL ADVISORY BOARDS.

## GENTLEMEN:

The chief reason for the Selective Service System is to provide men for the armed forces of the United States for service and training.

Local boards in their selection of registrants for induction should bear in mind that these men are chosen for a year of training and service and for 10 subsequent years in the Reserve. The men chosen for induction should therefore be those clearly capable of undergoing the physical demands and the mental stresses of military service and who may reasonably be expected to remain capable of service at any time during their years in Reserve status, should war come upon us.

Physical defects and ailments are not the only causes for rejection; mental and per-

sonality deficiencies are of coordinate importance. Not only are the feeble-minded and the "insane" unsuitable, but so also are certain of those handicapped people who are now doing well in civilian life only because they have found ways of protecting themselves from undue stress, by seclusiveness or by peculiar performances and odd habits of life.

Military life requires that the soldier shall be able to live comfortably in continued close contact with a variegated group of other men. He cannot depend on any self-evolved protective mechanism that sets him apart from his fellows. Military and naval experience is in favor of excluding from the armed forces all persons discovered to have mental or personality handicap of any material degree.

In the World War, a great many men who were inducted into the Army were not capable of meeting service conditions which aggravated the handicap of some, and permanently disabled others who could have been useful had they remained in civilian life.

It is obvious that men who are feeble-minded or are suffering from a gross mental ailment do not make good soldiers. The medical examination should be directed toward eliminating these cases as well as those physically defective. The appearance of such individuals before the draft boards may be expected, as there are numerous feeble-minded and insane persons who are not in institutions. An individual not feeble-minded enough or insane enough to require institutional care in civil life may still be too feeble-minded or too disordered in mind to make a good soldier. Many individuals who cannot be labeled "insane" are nevertheless likely to become so under stress, particularly under the kind of stress which Army life places upon such unstable persons.

Insanity is not the only condition that needs to be considered. There are mental ailments not severe enough to be called "insanity" which may nevertheless be

highly incapacitating or which may be incapacitating at intervals. Certain individuals suffer from mental ailments which are not apparent and will not become so, provided they are able to lead a type of life well adjusted to their particular needs, but when the particular circumstances which have sheltered and protected such individuals undergo some drastic change, these mental ailments do become apparent and incapacitating. Such men will be unable to manipulate the circumstances of Army life to create for themselves the necessary protective situation and will ultimately break down. Not only will they break down, but in the process, they will prove a disturbing and disruptive influence in their Army unit and be detrimental to its discipline, its efficiency, and its general morale.

Medical Circular No. 1 appended hereto should be of assistance to the physicians of local boards in detecting or suspecting the existence of mental disorders in men being examined. Psychiatrists are provided on medical advisory boards to give expert advice on matters in their specialty. Local boards and boards of appeal as well as examining physicians should not hesitate to seek the advice of these experts in cases where there is doubt about the mental fitness of any registrant.

Sincerely yours,

C. A. DYKSTRA,  
Director.

#### MEDICAL CIRCULAR

##### No. 1

#### FOREWORD

The purpose of this Circular is to present to physicians of Selective Service, the great majority of whom are not psychiatrists by profession, methods whereby they may suspect the existence of incapacitating mental and personality factors in registrants coming before them and may either eliminate such individuals or refer them to the psychiatrist of the medical advisory board for examination.

The Minimum Psychiatric Inspection which appears below, was prepared by the William Alanson White Psychiatric Foundation and offered to Selective Service Headquarters as a patriotic contribution to the national defense program.

The military forces can use individuals with many varieties of temperament and experience, but there is no place in an efficient army for the psychopath, the feeble-minded, or the insane. Many individuals so unfortunately affected may do quite well in civil life, in accustomed jobs and in familiar circumstances, but when they are introduced into the unfamiliar environment of military life, with its necessary regimentation, close contact with other persons, separation from their families and inability to escape without fear of grave penalties, they develop various types of mental disorder. These individuals then become a source of trouble to their superiors, exert a deleterious influence on their associates and occupy a disproportionate amount of hospital space. The experience of the World War showed that mental disorder in soldiers was one of the main problems present both in the United States and in the Expeditionary Force. Thirty percent of the patients now being returned to Canada from the Canadian Forces abroad are reported to be mental cases.

*The selecting out of the mentally unfit should begin at the time the candidate appears for the local board physical examination.* In many instances, the registrant and his circumstances will be known to the board members and physicians, belonging as they do to the same community, and this knowledge should assist greatly in reaching a wise decision as to his acceptance or rejection. Pertinent information may be obtained from various charitable and welfare agencies in the community.

#### A MINIMUM PSYCHIATRIC EXAMINATION OF REGISTRANTS

Mental or personality difficulties are revealed in the person's performances with other people who have come to mean something to him. Strangers may be met with an effective protective mask, a conventional manner. The examiner is a stranger unless and until he has overcome this reserve. This approach to the registrant can seldom be achieved by a show of force or authority. A pose of artificial friendliness is also unfortunate. The most successful approach is often one of straightforward pro-

fessional inquiry coupled with real respect for the registrant's personality and due consideration for his feelings—which does not mean diffidence.

Whenever possible, the psychiatric examination should be made outside of easy hearing of other men. Matter of diagnostic significance is often concealed when the individual feels that he must be impersonal and give replies that will not impress listeners with his peculiarity.

Questioning should begin with something that is obviously relevant to the immediate situation. One tries to elicit the difficulties which the registrant has been experiencing in his relations with others and with himself in his work and in his spare-time activities. The questioning might, for example, be somewhat as follows: The registrant being a machinist whose left index finger is badly scarred, the examiner asks how the injury occurred. There may follow a question as to just what job he has been doing; how many others are similarly employed in the shop; is it a pretty good crowd; does he like the work; is the employer fair? Have they treated him right; if not, secure details. What does he do with his spare time? With whom? Sociable, or prefers his own company? Try to discover how he is esteemed by his intimates; respected or otherwise. Is he self-reliant, sure of himself, or diffident, uncertain, chronically perplexed about something, shy? With men, with women, or both? If anything at all unusual comes to light, pursue the topic until it is understood. Has the registrant gotten into any bad habits? Did he "break them"? Can he, e.g., stop smoking whenever he wishes? Is he ashamed of his "weakness"? Has he a low opinion of himself; and if so, why? What do his friends think of him? Does he like the idea of being trained for the national defense? The examiner pays close attention to content and implication of everything said and to any other clues, and, in a matter-of-fact manner, follows up whatever is not self-evidently commonplace.

The examination is directed toward detecting any one of some five categories of handicap. The probable presence of some of these can often be detected by observing

the individual's behavior. In other cases one would not be able to suspect the presence of any morbid condition without some knowledge of the individual's history. In the following summary the first three types of ailment are detectable, as a rule, only upon the basis of the history, except in very marked cases of feeble-mindedness. The last two types, however, may often be suspected as a result of alert observation, if the observer knows what to look for and what to regard as significant.

It must not be supposed that any of the various kinds of behavior or items of personal history described in the following summary are absolutely and definitely diagnostic of anything in every case. The items are to be regarded as suggestive, often highly and importantly so, of the presence of the morbid condition indicated. It is possible that the presence of the behavior or the item of history in some particular individual may have little diagnostic significance. When the examining physician is in doubt, he should refer the individual to the medical advisory board for further examination.

**TYPE I.** *Mental defect or deficiency* is suggested by slowness or stupidity in complying with clear instructions. The school record often reveals poor learning ability. The psychiatrist of the medical advisory board will make or arrange for a psychometric test, if required.

**TYPE II.** Besides those who are deficient in intelligence, there are individuals of average intelligence who are more or less incapable of profiting from experience. Again and again, such a person has proved unreliable and disappointing to friends and family. He may talk well, but his record shows that he has been undependable and has habitually evaded responsibilities. He has always been deflected from his goals by rebuffs and disappointments. He is inadaptably to employment or to enduring group life and is wholly disqualified for any form of national service. Such an individual has a *psychopathic personality*.

**TYPE III.** *Major abnormalities of mood* are shown by episodes of unreasonable elation or depression which have tended to recur without obvious connection with events.

People who are known to be so mercurial in mood that their judgment is seriously impaired during the up or down swing of their moods should be rejected. Registrants known to have received medical or nursing care because of a morbid excitement or a depression should be rejected.

TYPE IV.—*Psychoneurotic disorders* are a more difficult diagnostic problem. The signs and symptoms fall more or less clearly into one or another of three major categories—the *hysterical*, whose physical signs and symptoms, often so dramatic that they may seem fraudulent, do not follow anatomically understandable patterns; the *morbidly anxious*, made up of various signs and symptoms of fear; and the *obsessional*, which include such varied conditions as hypochondriacal states (preoccupation with one's ill health), morbid fears (phobias), and rituals of action and thought which they feel compelled to carry out.

These conditions are likely to escape notice unless one is particularly looking for them. Circumstances which might suggest the possible existence of such conditions are as follows: The hysterical individual is eager to make known his physical ailment and is apt to tell of miraculous, last-minute escapes from impending death—e.g., he tells of abdominal cramps that "nearly killed him," of a heart attack in which he was "nearly a goner," and so on. The morbidly anxious individual, as a reaction to being examined, may show unusual sweating, obviously not due to being overheated, tremors, or a pulse rate indicating undue excitement. The obsessional individual may show insistence, usually in a somewhat embarrassed manner, upon performing some simple act in an unusual way, or in answering a question in a peculiarly circumstantial or indecisive fashion.

TYPE V. The fifth category comprises the grave mental or personality handicaps. *Pre- and post-psychotic personalities* and those actually suffering a *schizophrenic* ("Dementia praecox") mental disorder manifest their condition by obscurely motivated peculiarities of behavior and thought. Of these, the so-called deteriorated states are the most obvious. Here belong the numerous shiftless, untidy, perhaps morose, some-

times nomadic individuals who had what was regarded as quite a normal childhood. Somewhere between the ages of 12 and 25, they underwent a change, acute or insidious, with dilapidation of their social interests and the habits in which they had been trained. They may or may not have received treatment in a hospital for mental diseases.

The paranoid personalities are another large division. These people cling to fantastic beliefs in their overweening importance, and often feel that people are persecuting them or otherwise interfering with their career or well-being. Some of them believe that they are in communion with supernatural beings. Others believe that they are victims of plots, secret organizations, spy rings, or religious or fraternal groups. They are often quite plausible in supporting these delusions by clever misinterpretation of facts. Some of them are very evasive and skilful at concealing the pattern of their disorder. A morbid suspiciousness of anyone who takes an interest in them is frequent. They may become tense and hateful when interrogated. An attitude of unusual cautiousness or suspiciousness towards the examining physician, towards others in the local board office, or towards fellow-registrants should suggest the possibility that the individual may be paranoid.

The catatonic and pre-psychotic states may present great difficulty in diagnosis. Perhaps the only obvious sign of these conditions is the impression of queerness which the person makes on anyone who seeks to get acquainted with him. The actual oddities of behavior or thought may be subtle; it may be difficult, in retrospect, to point to any particular instances of the unusual. The most striking signs of these conditions may, in fact, come out in connection with the *physical* examination. The physician, at some stage of the physical examination, may observe a peculiar reaction which upon questioning may awaken a suspicion of a pre-psychotic stage. These individuals frequently entertain unfounded convictions as to bodily peculiarities or disorders which they attribute to excessive sexual acts of one sort or another. These beliefs, some-

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times hard to elicit, are often medically incredible and bizarre. Questioning them on intimate personal matters often leads to great embarrassment, confused speech, or actual blocking of thought—so that they do not know what to say.

The local examining physician should request the reference to a medical advisory board of any registrant whose mental fitness or unfitness he cannot definitely determine.

THE BOARD OF EDITORS OF PSYCHOSOMATIC MEDICINE has been requested by the National Institute of Health to reprint the following informational résumé of the Institute's attempt to survey what work is being done by American scientists concerning the problems of aging.

The National Institute of Health of the United States Public Health Service is organizing a new unit for research into some of the many problems of aging. With the conspicuous shift to greater age in the population, senescent individuals are becoming increasingly significant in the national economy and defense. Preventive medicine must attack the practical problems of the rising proportion of deaths attributable to diseases of middle and later life and energetically attempt to augment the health and vigor of those past the meridian. Aging is a continuous biologic phenomenon which starts upon creation of a new individual and continues at variable rates until death. The problems of aging (gerontology) are not limited to the diseases of the aged (geriatrics), for the latter are the consequences of senescence. In man probably the most significant period of life for gerontologic study is late maturity, approximately the two decades between 40 and 60.

The problems of aging are logically divisible into three major fields of investigation: 1) the biology of senescence as a process, 2) the human clinical problems of aging and of diseases characteristically associated with advancing years which include the mental changes of senescence and senectitude as well as the physical changes,

and 3) the socio-economic problems of a shifting age distribution in the population. The National Institute of Health is concerned with the first two of these divisions of the science.

In order to advise this new unit, there has been formed a National Advisory Committee on Gerontology, representative of the scientific thought of the Nation. The membership of this Advisory Committee includes:—

Dr. L. R. Thompson, Director, National Institute of Health, U. S. Public Health Service

Dr. Anton J. Carlson, Physiologist, University of Chicago, National Research Council

Dr. Charles L. Christiennin, Association of Life Insurance Medical Directors of America; Medical Director, Metropolitan Life Insurance Co.

Dr. Robert A. Coker, Zoologist, University of North Carolina

Dr. William Crocker, Botanist, Boyce Thompson Institute of Plant Research

Mr. Lawrence K. Frank, Sociologist, Josiah Macy, Jr. Foundation

Dr. A. Baird Hastings, Biochemist, Harvard University

Dr. Ludvig Hektoen, Pathologist; Consultant, National Cancer Institute, U. S. Public Health Service

Dr. Winfred Overholser, Psychiatrist; Superintendent, St. Elizabeths Hospital

Dr. Clarence Selby, Industrial Physician, General Motors Corporation

Dr. William D. Stroud, Clinician, Philadelphia, Pa.

The first service to scientific research which the Unit of Gerontology is undertaking is to conduct a survey of the present trends of active and contemplated investigations into the problems of aging in American scientific institutions. This survey is intended to ascertain just what problems are being studied and what methods of approach are being applied. There is no desire to learn, in advance of publication, the data being developed in these specific undertakings.

In addition to these studies, many investigations which do not pertain directly to aging should yield data useful to workers

in gerontology. The Unit on Gerontology is especially interested in knowing of these indirectly related studies, the full implications of which are far too often obscured in their published titles.

Inquiries about studies related to aging are being sent to scientists in the basic biologic sciences as well as to clinical investigators, for much fundamental work upon the processes, mechanisms and consequences of senescence is probably going on in the sciences of botany, zoology, physiology, pharmacology, psychology, etc. From the clinical viewpoint, our greatest concern is with those studies dealing with health evaluation mensuration of functional capacity (including criteria of "physiologic age") and with those diseases whose incidence increases sharply in later life (the so-called "degenerative disorders").

Critical analysis of the information elicited by such a survey may be expected to serve several valuable purposes. It should assist in bring together in closer cooperation investigators interested in related problems, especially when widely divergent methods of approach are being utilized. The survey will likewise emphasize the urgent need for greatly augmented support for significant studies of these vitally important problems of senescence.

The broad and general pattern of the problems being investigated will undoubtedly reveal a number of neglected "Blank

spots" which may justify special emphasis in the future. Analysis of the data of the survey will also be an invaluable aid in formulating future research programs, both at the National Institute of Health and elsewhere.

From preliminary inquiries it is observed that there is a great but largely latent and scattered interest in the problems of aging. It is the hope of the unit of gerontology of the National Institute of Health that the present survey may serve to effectively aid the promotion of closer cooperation of the scientists interested in these fields.

Information concerning subjects under investigation and the methods of approach is earnestly solicited. Letters should be addressed to—

DR. EDWARD J. STIEGLITZ

In Charge

Investigations in Gerontology

National Institute of Health

U. S. Public Health Service

Bethesda, Md.

The Eighteenth Annual Meeting of the American Orthopsychiatric Association, an organization for the study and treatment of behavior and its disorders, will be held at the Hotel Pennsylvania, New York City, on February 20, 21 and 22, 1941. A registration fee will be charged for non-members. Preliminary program will be sent on request.

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